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ROAD FROM KYOTO, PART III: STATE DEPARTMENT OVERVIEW

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Serial No. 105- 75, March 5, 1998 (105-2 Hearing)

HEARING

BEFORE THE

COMMITTEE ON SCIENCE
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTH CONGRESS

SECOND SESSION

MARCH 5, 1998

SERIAL NO. 105–75

Printed for the use of the Committee on Science

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HEARING ON THE ROAD FROM KYOTO—PART 3: STATE DEPARTMENT OVERVIEW

THURSDAY, MARCH 5, 1998

House of Representatives,
Committee on Science,
Washington, DC.

The Committee met, pursuant to notice, at 12 noon, in room 2318, Rayburn House Office Building, Hon. F. James Sensenbrenner, Jr., Chairman of the Committee, presiding.

Chairman Sensenbrenner. The Committee will be in order. Before we get to Secretary Eizenstat, there is one bit of housekeeping business relative to the election of Ranking Democratic Members to the Floor Subcommittees of this Subcommittee. Pursuant to notice, I call up the issue of the motion to approve the election of Ranking Democratic Members and recognize the gentleman from Indiana, Mr. Roemer, for a unanimous consent request.

Mr. Roemer. I thank the gentleman, the Chairman from Wisconsin, and Mr. Chairman. The departure of Representative Bud Kramer from the Committee has left a vacancy in the Ranking Democratic Member position on the Space and Aeronautic Subcommittee. After notice, the Democratic Caucus of the Science Committee met on February 4, 1998, and approved the following Members to serve as Ranking Democratic Members for the remainder of this Congress: the Honorable Bart Gordon, Ranking Democratic Member, Subcommittee on Space and Aeronautics; the Honorable Tim Roemer, Ranking Democratic Member, Subcommittee on Energy and Environment; the Honorable Jim Barcia, Ranking Democratic Member, Subcommittee on Technology; the Honorable Eddie Bernice Johnson, Ranking Democratic Member, Subcommittee on Basic Research.

Mr. Chairman, by direction of the Democratic Caucus, I move the adoption of the above election of the Ranking Democratic Members.

Chairman Sensenbrenner. Without objection, the elections as stated by the gentleman from Indiana are approved, and the motion to reconsider is laid upon the table.

This marks the Science Committee's third hearing on the Kyoto Protocol, the UN treaty that would mandate the United States to cut its greenhouse gas emissions by 7 percent below 1990 levels by the Years 2008 and 2012. Today, we turn our focus to the State Department. As I said at the Committee's opening hearing on February 4, I believe the Kyoto Protocol to be seriously flawed—so flawed, in fact, that it cannot be salvaged. This treaty is based upon immature science; costs too much; leaves too many procedural questions unanswered; is grossly unfair because developing countries are not required to participate and will do nothing to solve the speculative problem it is intended to solve, and I have heard nothing to date that would persuade me otherwise.

So, let me briefly recap what I consider the highlights of what we've heard so far. At our first hearing on February 4th, Dr. Jay Hakes, the Administrator of the Energy Information Administration, testified that the Kyoto Protocol would require the United States to cut carbon emissions by some 550 million metric tons or 31 percent below the levels expected in 2008 to 2012. And in a refreshing burst of candor, Dr. Hakes said, "It is unlikely the adjustments can be achieved without a significant price mechanism," and that "[u]nder most scenarios the price mechanism selected would slow somewhat the rate of economic growth." Or—translated into plain English—he said the only way we can meet the emissions reduction targets mandated in the treaty is through a significant increase in energy prices and that this will hurt our economy.

At our second hearing on February 12th, we considered the Administration's Fiscal Year 1999 budget requests that are directly related to the Kyoto process including the Administration's proposed Climate Change Technology Initiative. This initiative, a 5-year package which includes $2.7 billion for research and technology and $3.6 billion for tax credits to reduce U.S. greenhouse emissions, represents a spending increase of about $473 million, or nearly 58 percent, for all agencies with the bulk of that increase going to the Departments of Energy and the Environmental Protection Agency.

I came away from this hearing with three major concerns about the Initiative: First, the research and technology portion is light on funding for research and generic technology development and heavy on funding for commercialization activities that are more appropriately the business of the private sector; second, the tax credits further complicate an already unmanageably complex tax code; and, third, funding for the initiative is included as part of the Administration's Research Fund for America, whose funding relies on uncertain tax increases and unsettled deal and unspecified program reductions.

Finally, I want to comment on the tenor of the testimony we have had for most Administration witnesses.

Instead of making reasoned and factual arguments for its case for the Protocol that are based on sound and transparent analyses, Administration after Administration witness has repeated "sky is falling" speculations about the potentially negative impacts of the climate change—speculations that are apparently designed to alarm the American public and to demonize the opposition, and looking at the charts to my left, it kind of looks that way today as well.

This is particularly ironic when analysis after analysis, including one by Professor Bert Bolin, Chairman Emeritus of the IPCC, in the January 16, 1998 issue of *Science* magazine, shows that the Protocol will have little or no impact on the buildup of greenhouse gases in the atmosphere or in the environment.

The Administration's tactics remind me of the adage that I learned in law school about arguing a case: if the facts are with you, you pound the facts; if the law is with you, you pound the law, and if neither the facts nor the law are with you, you pound the table.

It appears to me that the Administration is doing a lot of table pounding and very little fact pounding.

That being said, I am pleased to welcome as our sole witness today, the Honorable Stuart E. Eizenstat, Under Secretary of State for Economic, Business, and Agricultural Affairs. Mr. Eizenstat headed the U.S. negotiating team at Kyoto, and those of us who were there marveled at his stamina and endurance in participating in marathon negotiating sessions to the extent that we even gave him our bus to get there early one day. It appears from his schedule that Mr. Eizenstat is trying to top that feat; this hearing is his third on Kyoto this week and his second today.

I do want to acknowledge that Mr. Eizenstat had requested that he be accompanied by Ms. Janet Yellen, Chair of the Counsel of Economic Advisors, to present the Administration's economic analysis of the Protocol. We readily accepted that request with the caveat that Mr. Eizenstat and Ms. Yellen appear on a panel of outside witnesses which could provide comments on the Administration's economic analysis. Mr. Eizenstat's office stated a preference that he appear alone, and we have honored that request. I can assure you that the Committee will take up the Administration's economic analysis at a later date and add Ms. Yellen as the leadoff witness.

So, Mr. Eizenstat, I welcome the opportunity to hear you pound the facts today, and I look forward to a vigorous exchange of views on the Protocol and yield to the gentleman from Indiana, Mr. Roemer, for an opening statement.

Mr. ROEMER. I thank the Chairman and, first of all, I'd ask unanimous consent that Mr. Brown's entire statement be entered into the record.

Chairman SENSENBRENNER. Without objection, the request is granted, and, without objection, all members will be allowed to insert opening statements in the record at this point.

[The prepared statements of Mr. Brown, Ms. Jackson Lee, and Ms. Johnson follow:]

STATEMENT
HON. GEORGE E. BROWN, JR.
Ranking Minority Member
Committee On Science
Us House Of Representatives

March 5, 1998

Mr. Chairman, today's hearing is the third in a series of hearings on the Kyoto protocol. Climate change and the Kyoto protocol are obviously topics of environmental, economic, and political significance, as evidenced both by this Committee's interest and the interest of many other House and Senate Committees.

I want to thank our witness today, Under Secretary Stuart Eizenstat, for his marathon appearance on the Hill yesterday and today. This hearing is his third in two days, and I am confident that those prior dress rehearsals will result in a superlative performance here today.

Mr. Under Secretary, you were not able to be here to listen to me sing your praises when the Committee held its first hearing on the Kyoto agreements in early February. So let me just briefly repeat my observation that the U.S. negotiating team which you led was remarkably successful in bringing a very wary group of developed nations around to our way of thinking about the best way to deal with climate change. The flexible, market-based approaches we championed were reflected in the Kyoto accord. This means that we can address the climate change problem by harnessing the innovation of the private sector, not by cumbersome and costly governmental edicts or international bureaucracies. This success is largely due to the skill and diligence of the U.S. negotiating team, and I want to commend you for your excellent efforts.

As the Administration recognizes, however, more needs to be done before we have a treaty that we can adopt. In particular, we need to secure the commitments of key developing countries to do their part to reduce greenhouse gas emissions. We also need to agree on many critical implementation details, including emissions trading, the Clean Development Mechanism, sinks, and sanctions.

I look forward to hearing today how the Administration proposes to put together the final elements of a satisfactory agreement that can be ratified by the Senate.

SHEILA JACKSON LEE
18th District Texas

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713-655-0050

STATEMENT FOR
ON ROAD FROM KYOTO PART 3:
STATE DEPARTMENT OVERVIEW

MARCH 5, 1998

Sheila Jackson Lee

Mr. Chairman:

Allow me to welcome the Honorable Stuart E. Eizenstat, Under Secretary of State for Economic, Business and Agricultural Affairs, who was the U.S. delegation's chief negotiator at Kyoto.

Issues of the environment and the economy are of the utmost importance to the future of not only the health of global business interests, but also the health of the American people.

The reduction of greenhouse gases and smog should be an environmental priority for the United States. I am a supporter of sound environmental policy and am hopeful that the Kyoto agreement is a step in the right direction.

The protection of the environment is of the utmost importance to me and should permeate the minds of each of us here when we draft, debate and pass legislation that will serve to protect the American people. The U.S., with the Kyoto agreement, is in the driver's seat, with the ability to lead the world in setting efficient and effective international environmental policy that makes sense. There is no doubt that the rest of the world is watching the United States.

Houston, Texas is home to many of the leading energy companies in the world. The ability of these companies to compete effectively in a global marketplace is greatly affected by the policies and regulations promulgated by this committee.

It is evident that the success of this environmental protection effort is largely dependent on private action. Consequently, we must act to implement policy that will enable the private sector to comply with sensible environmental standards. To this end, I am encouraged by the idea of international emissions trading found in Article 6 of the Kyoto agreement. Under an emissions trading regime, countries or even companies can purchase less expensive emissions permits from countries that have more permits than they need, possibly due to these countries having met their emissions target. This international emissions trading tool can seemingly provide a good and strong incentive to reduce emissions, while at the same time allowing for flexibility for implementing actions that are cost effective.

During the Kyoto conference, the U.S. was quite successful in developing the framework for these emissions targets outlined in Article 3 of the agreement. These targets are to be reached over a five-year budget period, rather than a single year. According to the State Department, allowing emissions to be averaged across a budget period increases flexibility by helping to smooth out short term fluctuations in economic performance.

The first budget period will be the U.S. proposal of 2008 - 2012. The parties to the convention rejected proposals that were neither realistic nor achievable. According to the State Department, having a full decade before the start of the binding period will allow more time for U.S. companies to make the transition to greater energy efficiency and/or lower carbon technologies.

While implementation of this agreement has the commendable purpose of securing a cleaner and more livable environment, several important issues still remain. The economic impact of the agreement to U.S. industries, the outlining of a detailed emissions trading process, as well as the role of developing nations and their "meaningful participation" in this agreement are all issues that must be addressed.

The President's FY 1999 budget request includes the Climate Change Technology Initiative (CCTI), which is a five year, $2.710 billion research and technology initiative, along with a $3.635 billion package of tax credits, which has as its purpose to reduce U.S. greenhouse gas emissions. Additionally, $1.864 billion was requested for the U.S. Global Change Research Program (USGCRP). As you know, this request is a result of Members of the Congressional delegation stating publicly at the conference in Kyoto that any agreement reached should be supported by a credible FY 1999 budget request.

There is no doubt that the United States' commitment to reducing greenhouse gas emissions and the efforts of the State Department allow us to better prepare for the healthy well being of our people in the U.S. and throughout the world. This effort should be supported.

FULL COMMITTEE HEARING
"THE ROAD FROM KYOTO--PART 3"
RAYBURN 2318
3/5/98

Eddie Bernice Johnson

STATEMENT
CONGRESSWOMAN EDDIE BERNICE JOHNSON

Thank you Chairman Sensenbrenner for convening this hearing on the Kyoto Treaty.

The U.S. is heading down the right path by committing themselves to the reduction of emissions. I am pleased that the U.S. has agreed to cut 7 percent below their 1990 level of emissions through implementing new technologies, programs, and tax credits. In comparison, Japan has agreed to cut 6 percent and the European Union has agreed to cut 8 percent below their 1990 level of emissions.

In order to implement these reductions, one of the noteworthy programs the Federal Government has created is the Climate Change Technology Initiative Program. This research and technology effort is led by the Department of Energy (DOE) and the Environmental Protection Agency (EPA), and also includes activities of the National Institute of Standards and Technology (NIST), the Department of Agriculture (USDA), and Housing and Urban Development (HUD).

The FY 1999 budget proposes a combined $2.7 billion increase over five years for these agencies for energy efficiency, renewable energy, and carbon-reduction technologies. These efforts will impact a number of key sectors. In addition, the budget proposes $3.6 billion in tax credits over the same five-year period for emission reduction practices.

Each agency will implement different initiatives which will reduce emissions in several ways.

- DOE will allocate monies to increase the efficiency of lighting, refrigerators, air-conditioning systems and other building equipment and to improve whole building designs.

- EPA will allocate monies to promote greenhouse gas reduction and improve energy performance of facilities by increasing awareness of energy efficient technology that is applicable for both residential and commercial buildings. Also, EPA will do outreach to state and local entities to integrate climate change into programs and policies and engage developing countries in the implementation of climate change technologies.

- NIST will improve their measurements of greenhouse gas data and support biotechnology work.

- HUD will manage the PATH program which demonstrates housing technologies so that homes can be built cheaper and more environmentally sustainable.
- USDA will support additional research on the conversion of wood and crop wastes to fuel electricity.

I believe that these agencies should be commended for their efforts to solve our emission problem. Only when all entities work towards the same goal can we find numerous solutions to deal with the reduction of emissions. Every individuals should be prepared to be part of the solution to reduce emissions. We must be prepared to spend money to implement energy efficient technologies in order to make our environment clean and safe.

I would like to call your attention to the data released by the White House concerning the costs the average American household will have to pay to reduce emissions. If the Kyoto Treaty is implemented, the average American household's energy bill may see an additional $70 to $110 included over the next 15 years. This modest amount is necessary if we are to reduce emissions in a timely fashion. We may see our gas prices go up 4- to 6 cent per gallon as well. For many, this may seem a hefty price to pay for reducing emissions, but this is an invaluable price to pay in order to save our nation from environmental disaster.

I hope that we will do our best to preserve our environment for generations to follow. If not, our children will grow up in an environment where the air is dirty, the waters are muddy, and the temperatures are unbearably hot. Let us commit to maintaining a healthy environment.

Thank you.

Mr. ROEMER. I thank the Chairman, and my records—my recorded comments here will be very brief. First of all, I want to welcome Stuart Eizenstat before the Committee. He is a very gifted and talented public servant who served President Carter as Chief Domestic Policy Advisor in the White House and did a superb job there. He is now serving President Clinton in an exemplary fashion. He has got a tough job working on the Kyoto accord in this issue that he is telling our Committee about today.

I would applaud the Administration for, particularly, the positions they took in very innovative and creative and bold ways going into Kyoto. I thought the Administration took a very good approach in terms of presenting our arguments with some very new ideas. I'm hopeful—and if anybody can do it, Stuart Eizenstat can do it—is to continue to try to move back to those positions in Kyoto and try to get some of these developing countries involved in this treaty.

With that, I want to, again, come back to my admiration for Mr. Eizenstat for the job he's done in the past; for the job he is doing now; for the job he will do in the future. He is a friend of mine; he is a friend of my family's, and it is with great pride that we welcome you today before the Committee.

Chairman SENSENBRENNER. And I, certainly, also want to welcome you, and I do associate myself with the remarks of Mr. Roemer about your talents, Mr. Eizenstat, even though we may have somewhat of a disagreement on this issue.

Before asking you to proceed, without objection, the Chair has granted authority to recess the Committee during votes this afternoon. Mr. Eizenstat, without objection, your full statement will be placed in the record at this point. We would like to ask you to summarize your statement in 5 to 8 minutes or so. That way, we can get you out of here by your announced departure time at 2 p.m., and all of us can get back to our Districts, then, too. So, Mr. Eizenstat, please proceed as you will.

STATEMENT OF THE HONORABLE STUART E. EIZENSTAT, UNDER SECRETARY OF STATE FOR ECONOMIC, BUSINESS, AND AGRICULTURAL AFFAIRS, U.S. DEPARTMENT OF STATE, WASHINGTON, DC

Mr. EIZENSTAT. Let me start by thanking Congressman Roemer and yourself for your kind remarks and thanking you personally, Mr. Chairman, for the enormous amount of time and effort you put into going to Kyoto; your interest and involvement, and I think that, although I understand your position, we certainly had an excellent communication and a regular communication, and I appreciated very much you and your colleagues participation.

I'd like to discuss four things: first, the science, and to do so in non-hyperbolic terms; second, the key features of the Protocol; third, to correct some misperceptions, and, fourth, to review the President's own Climate Change Technology Initiative.

First, on the science, there is, I think now, a fairly clear scientific consensus that human beings are, indeed, changing the climate by increasing the global concentrations of greenhouse gases. Over the last century, greenhouse gases have been released to the atmosphere far faster than natural processes can remove them, and, here, there is really no ambiguity in the data.

The first chart to my extreme right shows actual data taken from core samples by scientists. The orange data is data that has been taken since 1957, continual measurements of atmospheric CO_2 concentrations by scientists at an observatory in Hawaii, and they indicate, quite dramatically and clearly, that the concentrations of greenhouse gases have grown by some 30 percent and, particularly, since 1960. You can see the increasing slope of these concentrations in the orange from 1960 to the present. That slope will continue and increase dramatically.

Records of past climate going back as far as 160,000 years indicate a close correlation between concentrations of greenhouse gases and global temperature changes. Computer simulations of the climate indicate that global temperatures will rise as atmospheric concentrations of CO_2 increase. The authoritative 1995 intergovernmental panel on climate change, representing the work of more than 2,000 of the world's leading climate change scientists from more than 50 countries, represented the best synthesis of the science on climate change. They indicated that under a business as usual scenario, concentrations of greenhouse gases could exceed levels not seen for 50 million years. The projected temperature increases of 2 to 6.5 degrees over the next 100 years would exceed rates of change not seen for the last 10,000. The chart that is closest to me, the second chart, indicates this clear correlation between concentrations and temperature increases, and the bank indicates the degree of difference in terms of how much the temperature will increase but that it will increase seems quite clear. Indeed, this IPCC study already found that the Earth had warmed about 1 degree fahrenheit over the last century beginning with the industrial revolution and found that the evidence suggests that this is coming from a discernable human influence on global climate.

Increased temperatures will speed up the global water cycle; lead to a drying of soils, and in some areas increase drought. Sea levels are expected to rise between 6 and 37 inches over the next century. This, again, is not an attempt at scare tactics. Global mean sea level has already risen over the last 100 years 4 to 10 inches, mainly because water expands when heated and because the melting of glaciers, which discernibly, measurably, has occurred worldwide over the last century, contributes to this rise in sea levels. A 20-inch sea level rise would double the global population at risk from storm surges and low lying areas in places like coastal Louisiana and the Florida Everglades as well as other parts of the world would potentially occur.

Formally frozen soils, so-called permafrost, in the Alaska and Siberian Arctic have also begun to melt. Again, this is measurable. This is not conjecture; this is not wild speculation; this is actual measurement. It will damage both ecosystems and infrastructure. Melting and tundra warming will lead to the decay of organic matter and the release of trapped carbon and methane creating an additional source of warming.

This will affect human health as well. It will exacerbate air quality problems and diseases that thrive in warmer climates. It's been estimated that by the end of the next century there would be an additional 50 million to 80 million cases of malaria each year if this climate change continues unabated.

And only in yesterday's Washington Post, executives from leading oil companies—Shell, Texaco, BP, and others—indicate that, in fact, there is a climate change occurring and that human conduct is having an impact. As one says, we're moving beyond denial and that the other indicates that it's time to move beyond the scientific notion and determine what to do about it.

We look at Kyoto, Mr. Chairman and members of the Committee, as an insurance policy. It's an insurance policy against potentially devastating and irreversibly impacts of global warming. If we act now, the premium on this policy will be reasonable and less costly than if we delay in the hope that the problem will somehow go away. It's a little bit like you and I deciding to wait until we're middle-aged before buying an insurance policy and finding that the premiums are, obviously, much more expensive than if we had purchased earlier.

But, in this case, we won't have a second chance. Failure to act could lead to irreversible consequences and we'll be committing our children and grandchildren to a very different planet. There is a lag time, Mr. Chairman and members of the Committee, between the buildup of concentrations—which are, again, absolutely, scientifically determined—and the concentration levels and consequent temperature increases. So, by waiting, we allow those increases to occur until it will cost infinitely more to act if we wait.

Second, is the Protocol, itself, Mr. Chairman and members of the Committee, and this represents—if I may respond to Congressman Roemer's point—it is a framework for action; it's not a finished product, but it has many of the elements that the President and Vice President directed us to get. In particular, there were three that were asked for. Two were fully achieved and the third we did not fully achieve, but we at least a down payment.

The first of those objectives was to get realistic targets and time tables among developed countries, and, here, we got the following: first, multi-year time frames rather than a single fixed year as many of the other countries wanted. This will give our industries much greater flexibility in terms of the target, because they don't have to hit it in 1 year; it can be averaged. In addition, the time frame that was selected, 2008 to 2012, was, as the Chairman will remember, the U.S. time frame; not the early periods preferred by the European Union, Japan, and others, and this will cushion the transition and give our industries and workers more time to adapt.

We also were able to get the concept of differentiated targets for key industrial powers ranging from 6 to 8 percent below baseline levels. So, our competitors are taking on similar—and in the case of Europe, greater—obligations than are we. When changes in the accounting rules for the gases and offsets for sinks—which I'll describe in a minute—are taken into account, the level of effort required to the United States is very close to the President's original proposal of stabilization representing at most a 3 percent real reduction below that proposal and, perhaps, less.

We also were successful in getting an innovative proposal called Sinks. This was shaped, in part, by the United States to allow activities like planting trees and good forest practices, in which we excel beyond any country in the world and which absorb carbon dioxide, to be used to offset emissions requirements that industry would otherwise have to make. In a way, it's like saying that for every that's planted in the United States we can take a burden off a particular industry in terms of meeting the targets.

We also succeeded in covering all six greenhouse gases which was a desire not only by the environmental community but by our industry as well, and the European Union and Japan fought until the bitter last minute to cover only three.

Our second objective was to achieve these targets by flexible market mechanisms. Now, the European Union, Japan, and others argued, "No, we should have harmonized policies." That was a euphemism for top down regulation and for carbon taxes. We said, "No, that is not the way we're going to do it. We're going to do it by flexible market mechanisms rather than mandatory policies," and Kyoto enshrines, in article 17, a centerpiece of this U.S. market-based approach and that is emissions trading; the opportunity for companies and countries to trade. In this way, companies and countries can purchase less expensive emissions permits from other companies and countries that have more permits than they need. This is not only environmentally sound but it makes great economic sense.

Mr. Chairman and members of the Committee, this is not a pipe dream. We already have emissions trading in the United States in our acid rain program, and it has reduced the projected costs of that program by 50 percent while meeting our environmental objectives. So, the inclusion of these market-bases mechanisms and the right to trade in the open market was a signal victory for the United States. Indeed, one of the reasons I have to leave at 2 p.m. is because we're hosting a meeting with Australia, Canada, Japan, New Zealand, Russia, and the Ukraine which formed an umbrella group to talk about how we can trade more efficiently between us.

Let me be very clear: the commitment we made in Kyoto would not have been made and could not have been made were it not for the flexibility of that market-based mechanisms give us. Until we're satisfied with the rules and procedures yet to be established, the promise of Kyoto will not be realized.

Our third objective at Kyoto was to secure meaningful participation of key developing countries; obviously, a concern of the Congress; of the Senate; of the House, and of this Committee. Obviously, global warming is a global problem by definition. It requires a global solution. By sometime around 2025—some say 2015; some say 2035—the developed world will be emitting less greenhouse gases than the developing world, and the developing world will be emitting more. There was significant resistance in Kyoto—which I know, Mr. Chairman, you will remember very well—by some developing countries. Still, developing countries, may, as a prerequisite for engaging in emissions trading—a real incentive—voluntarily assume binding the targets through amendments to the annex of the Protocol that lists countries with targets.

Let me be very clear and very candid: the Kyoto Protocol does not meet our requirements for developing country participation. Nevertheless, even here, we made a significant down payment in the form of a provision suggested by Brazil and backed strongly by the United States, called the Clean Development Mechanism, which embraces our concept of a joint implementation with credits program. Here, again, we're using flexible market mechanisms, but here we're engaging the developing world. This will bring a bridge with incentives between the United States and other developed countries and developing nations allowing our companies here or elsewhere in the developed world to invest in projects abroad, clean power plants, forestation projects, and the like, and to get credit for it against their emissions targets, again, lowering the burden on U.S. industry by allowing this kind of participation. They can either invest or they can simply purchase the permits.

Now, in determining what is meaningful participation by developing countries, circumstances differ. What would be relevant for a Singapore or an Israel or a South Korea and Mexico—which are in the OECD in the latter two cases—may be very different than Bangladesh.

Third, I'd like to briefly clear up some misconceptions. The first misconception is that Kyoto somehow will imperil the ability of our military to meet its worldwide responsibilities. This is absolutely untrue. We took special pains working with the Defense Department and our uniformed military—one of whose representatives was with me at Kyoto—to fully protect our unique position as a worldwide super power with global military responsibilities. We achieved everything that we were asked by the Defense Department to do. For example, at Kyoto, a decision was made to exempt key overseas military activities from any emissions targets including exemptions for so-called bunker fuels that are used in international aviation and maritime transport by our military and from emissions resulting from multi-lateral operations including self-defense, peacekeeping, and humanitarian relief. This would exempt from our national targets not only multi-lateral operation expressly authorized by the UN Security Council like Desert Storm or Bosnia, but importantly multi-lateral operations like Grenada that were not authorized by the Security Council but which are consistent with the Security Council's—with the UN security charter which allows self-defense. Secretary Cohen indicated in a recent letter to the House that the Defense Department is fully satisfied with the Kyoto results.

A second misconception is somehow the Protocol will create a super UN Secretariat with intrusive verification. This is also not true. The verification largely codifies existing practices under the 1992 Rio Convention, and the review process will not be done by some UN Secretariat but by experts nominated by governments. The review teams will meet with government officials and with others only by invitation. Site visits will take place—and I underscore this—only if approved by the host country including, obviously, the United States, and no one will go on private property in the United States of America unless the owner of that property expressly agrees. So, the notion that somehow people are going to be swooping down by unannounced helicopters on U.S. private property is utterly, completely, and totally false. We will not accept nor do we anticipate an approach which will require UN approval of individual emissions trades either.

Last, Mr. Chairman, where do we go from here? First, we have to adopt rules and procedures to assure that this emissions trading and joint implementation are operating efficiently and smoothly. I'll be working, and our team will, closely with our industry to be sure that they're satisfied that the system is developed in a way that's efficient and effective for them. We also have to work to secure meaningful participation of key developing countries. We'll be putting on a full court diplomatic press which has already begun to achieve this. We will accept nothing less, and we know you will accept nothing less. As the President's indicated, we not assume binding obligations under the Protocol on this country until key developing countries meaningfully participate in meeting the challenge of climate change.

It, obviously, would be premature to submit something to the Senate when the Senate, itself, has asked for this kind of participation, and we have not yet achieved it. That's our obligation over the coming months and, if necessary, coming years.

Further, let me say, that to lock in the progress we've and that I've described with the developed countries, we anticipate signing the Protocol sometime between mid-March of this year and mid-March of next year when it is open for signature. We haven't as yet determined the precise timing due to tactical considerations. We'll sign at a time which makes the most sense in terms of our diplomatic situation.

Last, Mr. Chairman, is the President's own proposed initiative; as you mentioned in your opening statement, a $6.3 billion technology initiative of tax cuts and R&D incentives. This country—and I think your Committee will be central to this—this country has an unparalleled capacity for innovation and for developing technological solutions to problems. When Jack Smith, the President of General Motors, talks only a few weeks ago about the fact that he's going to produce a car that will get twice the gas mileage that our current cars will make, and that he was going to produce this in several years; when Texaco talks about the fact that they're going to be producing a special conversion program for natural gas to reduce the amount of natural gas that's flared, we know that we have the technological capacity—and this, again, I think this Committee is going to front and center in helping us meet these obligations and create jobs at the same time. Indeed, when I was Under Secretary of Commerce, we created a special unit on environmental exports. Environmental exports, members of the Committee and Mr. Chairman, are the fastest growing exports the United States has, and these countries are going to be hungry for our exports of environmental technology, Honeywell measuring devices and the like, so that they can meet their obligations.

So, I look forward to working with you, Mr. Chairman—as we did in Kyoto—with your Committee; with the Congress. All I would say is this, the science is there. We would risk ignoring it. We can purchase an insurance policy now at a very reasonable cost, and if we ignore the science and we assume that this problem will go away, we will wake up a decade from now and have to pay far, far greater costs than the moderate costs we can assume now. Thank you very much for your attention.

[The prepared statement and attachments of Mr. Eizenstat follow:]

Statement of
Stuart E. Eizenstat
Under Secretary of State
for Economic, Business and Agricultural Affairs
before the
House Science Committee
March 5, 1998

Thank you, Mr. Chairman.

At the outset, let me thank those members of Congress, in this chamber and in the Senate, who participated with us in the Kyoto Conference and who lent their advice and support to our efforts there. Rarely has there been an environmental issue more important or complex than global warming, and rarely has there been a greater need for the Executive Branch and the Congress to work closely together.

It is with great pleasure that I appear here today to explain the Administration's position on global warming. To this end, I will divide my testimony into four parts: (1) a short discussion of the science – the driving force for all the efforts we have taken to date to mitigate a significant and growing global environmental problem; (2) a discussion of the results of the recent Kyoto Conference and key features of the Kyoto Protocol; (3) an effort to correct misperceptions; and (4) a brief review of the President's Climate Change Technology Initiative. I hope to leave you with a clear understanding of why we believe that it is necessary to act, of how we intend to proceed internationally, and of what the President plans to do here at home.

The Science

Human beings are changing the climate by increasing the global concentrations of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Burning coal, oil and natural gas to heat our homes, power our cars and illuminate our cities produces carbon dioxide and other greenhouse gases as by-products – more than 6 billion metric tons worth of carbon in the form of carbon dioxide annually. Similarly, deforestation and land clearing also release significant quantities of such gases -- another 1 to 2 billion tons a year. Over the last century, greenhouse gases have been released to the atmosphere faster than natural processes can remove them. There is no ambiguity in the data; since 1860, concentrations of carbon dioxide have risen 30 percent, from 280 parts per million (ppm) to 365 ppm.

In December 1995, the authoritative Intergovernmental Panel on Climate Change (IPCC), representing the work of more than 2,000 of the world's leading climate change scientists from more than 50 countries, concluded that "the balance of evidence suggests that there is a discernible human influence on global climate."

The IPCC Assessment represents the best synthesis of the science of climate change. It concludes:

- Concentrations of greenhouse gases could exceed 700 ppm by 2100 under "business as usual" -- levels not seen on the planet for 50 million years. The projected temperature increase of 2 to 6.5 degrees Fahrenheit over the next 100 years, could exceed rates of change for the last 10,000 years. For perspective, while there is some uncertainty, tropical sea surface temperatures in the last ice age were anywhere from 2 to 9 degrees Fahrenheit cooler than today.

- Increased temperatures are expected to speed up the global water cycle and exacerbate weather extremes. Faster evaporation will lead to a drying of soils and in some areas increased drought. Overall, however, due to the faster global cycling of water, there will be an increase in precipitation.

- Sea levels are expected to rise between 6 and 37 inches over the next century. A 20 inch sea level rise could double the global population at risk from storm surges -- from roughly 45 million to over 90 million, even if coastal populations do not increase. Low-lying areas are particularly vulnerable (e.g., much of coastal Louisiana and the Florida Everglades).

- Human health is likely to be affected. Warmer temperatures will increase the chances of heat waves (like the Chicago event in 1995 that killed over 400 people) and can exacerbate air quality problems such as smog, and lead to an increase in allergic disorders. Diseases that thrive in warmer climates, such as dengue fever, malaria, yellow fever, encephalitis, and cholera are likely to spread due to the expansion of the range of disease carrying organisms. By 2100, there could be an additional 50-80 million cases of malaria each year.

- Agriculture, forests, and natural ecosystems are also likely to be affected. The poorest countries, already subject to food production and distribution problems, will likely suffer the greatest agricultural impacts. Doubling current carbon dioxide concentrations could lead to a dramatic change in the geographic distribution of one-third of the Earth's forests. (For example, the ideal range of some North American forest species would shift by as much as 300 miles to the north in the next 100 years -- far faster than their ability to migrate on their own.) Such changes could have profound effects on parks and wildlife refuges, and lead to a reduction in species diversity.

What Changes Have We Seen to Date?

The earth's temperature is increasing: Scientists from our National Oceanic and Atmospheric Administration (NOAA), the U.K. Meteorological Office and the National Aeronautics and Space Administration (NASA) all recently announced that 1997 was the warmest year on record. In fact, nine of the last 11 years are among the warmest ever recorded.

The water cycle of the planet may be speeding up: Since the beginning of the century, NOAA estimates that precipitation in the United States has increased by about 5 - 10 percent, while the frequency of heavy downpours (where more than 2 inches fall in a day) has increased by about 20 percent. The United States has had many recent reminders of how costly extreme events can be: the Mississippi flooding of 1993 led to damages of between $10 and $20 billion; the Southern Plains drought of 1996 was estimated to cost $4 billion; and the Northwest floods of 1996-97 about $3 billion. We have yet to learn what the current floods in California will cost. While no single event can be attributed to global warming, increases in floods and droughts are expected as global warming occurs.

Action Needed Now

Some have argued that we can wait to act until all the details of the climate system have been fully understood. The science tells us that this is a recipe for disaster. We will only fully confirm predictions when we experience them. At that point it will be too late. The concentrations of greenhouse gases in the atmosphere continue to rise each year, and because these gases will persist for many decades to centuries, this problem is only slowly reversed. The earth will continue to warm and the seas continue to rise as long as we continue to load the entire atmosphere of the earth with greenhouse gases. The problem has developed over the course of a century and it will take many decades to solve. Already, we have another 1.0 degree Fahrenheit of warming in the pipeline from emissions that have previously occurred, so some impacts will happen no matter what actions we take. Nevertheless, we can still forestall many others if we begin taking cost-effective actions now.

We should look at the Kyoto Protocol as an insurance policy against the potentially devastating and irreversible impacts of global warming. This insurance policy is fully justified today, based solely on our current understanding of the science. If we act now the premium will be far more reasonable than if we delay and hope the problem created by greenhouse gases will go away. It is like a life insurance policy whose costs grow significantly if we delay year after year insuring ourselves.

But there is a critical difference in the case of the climate system. In most insurance policies, the loser can be made whole -- restitution is possible; the building can be rebuilt, the stolen car replaced, the fire or flood damage repaired. In the case of global warming, we will not have a second chance -- failure to act will lead to irreversible consequences. We will be committing ourselves, our children and our grandchildren to a very different planet, and they will never forgive us.

But the premium for this insurance policy must be reasonable. For this reason we rejected unrealistic targets in Kyoto; we insisted on full recourse to market-mechanisms; and we opposed mandatory policies and measures – like carbon taxes.

The totality of our scientific information, including that on vulnerability and impacts of global warming, provides a compelling reason to act.

Let me now turn to the recent Kyoto Conference.

Kyoto Protocol

Last December in Kyoto, Japan, the nations of the world reached agreement on an historic step to control greenhouse gas emissions which cause global warming. No sooner had the negotiating session ended, however, than some critics on both ends of the political spectrum, without a full examination of the results achieved, denounced the agreement as either too little too late or too much too soon. In fact, the Kyoto Protocol, reached only through the exercise of vigorous American leadership, represents an important achievement in the best interests of the United States. But it is a framework for action, a work in progress, not a finished product ready for Senate consideration.

U.S. Negotiating Objectives

In order to secure an effective agreement that is environmentally strong and economically sound, while protecting the unique worldwide interests of the U.S. military, President Clinton and Vice President Gore established three major objectives. As a result of the Kyoto negotiations, we achieved the first two – realistic targets and timetables for reducing greenhouse gas emissions among the world's major industrial nations, which fully protect the unique role of our military in its global reach; and flexible market-based mechanisms for achieving those targets cost-effectively. The third, meaningful participation of developing countries, will be the focus of our work in the coming months and years, but with the Kyoto Protocol we have made an important down payment.

Elements of the Kyoto Protocol and Related Decisions

Our first objective – realistic targets and timetables among developed countries – had to be a credible step in reducing the dangerous buildup of greenhouse gases, yet measured enough to safeguard U.S. prosperity at home and competitiveness abroad. In the end, we secured the key elements of the President's proposal on targets and timetables, often over the initial objections of the European Union and other developed countries. The agreement and related decisions include:

- The U.S. concept of a multi-year time frame for emissions reductions rather than a fixed, single-year target. The multi-year time frame will allow the United States, other nations and our industries greater flexibility in meeting our targets. Averaging over five years, instead of requiring countries to meet a specific target each year, can lower costs, especially given an uncertain future. The averaging can smooth out the effects of short-term events such as fluctuations in the business cycle and energy demand, or hard winters and hot summers that would increase energy use and emissions.

- The U.S. specific time frame of 2008-2012, rather than earlier periods preferred by the European Union and others, giving us more time to phase in change gradually and deploy new technologies cost-effectively, and thereby to cushion the effects on our businesses and workers.

- Differentiated targets for the key industrial powers ranging from 6% to 8% below baseline levels (1990 and 1995) of greenhouse gas emissions, with the United States agreeing to a 7% reduction. When changes in the accounting rules for certain gases and offsets for activities that absorb carbon dioxide are factored in, the level of effort required of the United States is quite close to the President's original proposal to return emissions to 1990 levels by 2008-2012, representing at most a 3 percent real reduction below that proposal, and perhaps less.

- An innovative proposal shaped in part by the United States, allowing certain activities, such as planting trees, that absorb carbon dioxide – called "sinks" – to be offset against emissions targets. This will both promote cost-effective solutions to climate change and encourage good forestry practices. As a major forestry nation this will be of special benefit to the United States.

- As proposed by the United States, the Kyoto Protocol covers all six significant greenhouse gases even though the E.U. and Japan proposed and fought until the last moment to cover only three. This was an important environmental victory – also supported by many in our own industry – because gases that other countries wanted to omit and leave uncovered (including substitutes for the now banned chloro-fluorocarbons that endanger the ozone layer) are among the fastest growing and longest lasting greenhouse gases.

Flexible Market Mechanisms

Our second broad Presidential objective was to make sure that countries can use flexible market mechanisms to reach their targets rather than the mandatory "policies and measures," such as carbon taxes, favored by the E.U. and many other developed countries.

The Kyoto Protocol enshrines a centerpiece of this U.S. market-based approach – the opportunity for companies and countries to trade emissions permits. In this way, companies or countries can purchase less expensive emissions permits from companies or countries that have more permits than they need (because they have met their targets with room to spare). This is not only economically sensible, but environmentally sound. By finding the least expensive way to reduce emissions, we will be providing a strong incentive for achieving the maximum level of emissions reductions at the least cost. The United States has had a very positive experience with permit trading in the acid rain program, reducing costs by 50 percent from what was expected, yet fully serving our environmental goals.

This was a new concept for developed and developing countries alike – some of whom fought it vigorously. But we have it firmly enshrined in the Kyoto Protocol and it is a critical way of ensuring cost-effective solutions. Its inclusion was a major victory for us.

We went even further by achieving a conceptual understanding with several countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to trade emissions rights with each other. This 'umbrella group' could further reduce compliance costs.

Ensuring that we can meet our target reductions cost-effectively will depend significantly on access to the flexibility mechanisms we fought hard to include in the Kyoto Protocol. Let me be very clear: The commitment we made in Kyoto would not have been made -- could not have been made -- were it not for the flexibility mechanisms that were also agreed there. Until we are satisfied with the rules and procedures yet to be established, the promise of Kyoto will never be realized. The importance of emissions trading was emphasized by CEA Chairman Yellen in her recent statements.

Meaningful Participation of Developing Countries

Our third objective was to secure meaningful participation of key developing countries, a concern that I know you, Mr. Chairman, and members of Congress obviously share, as evidenced by last summer's Byrd-Hagel resolution in the Senate. Global warming is, after all, a global problem which requires a global solution – not only from the developed world but also from key developing countries.

Per capita emission rates are low in the developing world and will remain so for some time, and over 70 percent of today's atmospheric concentrations of greenhouse gases attributable to human activities are the result of emissions by the industrialized world. At the same time, it is also true that by around 2015 China will be the largest overall emitter of greenhouse gases, and by 2025 the developing world will emit more greenhouse gases in total than the developed world. So from an environmental perspective, this problem cannot be solved unless developing countries get on board.

We encountered significant resistance in Kyoto by some developing countries to meaningful participation in solving the global warming problem. For example, we had sought to include a specific process through which advanced developing or newly developed countries could take on quantified emission limitation commitments and thereby take part in the international emissions trading regime. While a number of developing countries expressed interest in our proposal and supported it in Kyoto, others rejected it, and it was not possible to include such a specific process in the Protocol. Still, developing countries may nevertheless, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets.

Some developing countries believe – wrongly – that the developed world is asking them to limit their capacity to industrialize, reduce poverty and raise their standard of living. We have made clear that we support an approach under which developing countries would continue to grow – but in a more environmentally sound and economically sustainable way, by taking advantage of technologies not available to countries that industrialized at an earlier time.

The Kyoto agreement does not meet our requirements for developing country participation. Nevertheless, a significant down payment was made in the form of a provision advanced by Brazil and backed by the United States and the Alliance of Small Island States. This provision defines a "Clean Development Mechanism," which embraces the U.S.-backed concept of "joint implementation with credit." The goal is to build a bridge – with incentives – between developed, industrialized countries, and developing nations. This new mechanism will allow companies in the developed world to invest in projects in countries in the developing world – such as the construction of high-tech, environmentally sound power plants – for the benefit of the parties in both worlds. The companies in the developed world will get emissions credits at lower costs than they could achieve at home, while countries in the developing world will share in those credits, and receive the kind of technology that can allow them to grow without ruining their environment.

The Clean Development Mechanism has great potential, but developing countries will need to do more in order to participate meaningfully in the effort to combat global warming. In determining what developing countries ought to do, we should be aware that the circumstances of developing countries vary widely, along a kind of continuum. Some today are very poor; their greenhouse gas emissions are negligible and are likely to remain so for the foreseeable future. Others, whose greenhouse gas emissions are not substantial, are relatively well off. Some are poor on a per capita basis, but their greenhouse gas emissions today rival or surpass those of the most advanced industrialized nations. Still others have already joined ranks with the industrialized world in the OECD but have not yet fully accepted the added responsibility for protection of the global environment that comes with their new status.

Any 'one-size-fits-all' approach to the 'meaningful participation of developing countries' and to satisfy the Byrd-Hagel Resolution is thus unlikely to prevail. We found in Kyoto that even among the industrialized countries it was necessary to recognize the individual national circumstances faced by those differently situated in order to reach agreement, notwithstanding our common purpose. Similarly, any uniform, inflexible approach to the 'meaningful participation of developing countries' is unlikely to prevail.

As Senator Byrd said in his letter of December 15, 1997, to the President, and recently restated on January 29 in the Senate:

> "...binding commitments for developing nations should be paced according to the ability of each country to achieve greenhouse gas emission limitations appropriate to its national circumstances and economic growth. These limitations could be gradually implemented. Whether such commitments are in fact appropriate and represent best effort by each nation, will not be difficult to discern. As the saying goes, we will know it when we see it."

Recognizing our "common but differentiated responsibilities and respective capabilities" it will be necessary to develop an approach that provides for a meaningful global response to the threat of global warming, while acknowledging the legitimate aspirations of developing countries to achieve a better life for their peoples. To succeed, we will need to ensure that those responsible for a significant share of global emissions accept their responsibility to protect the global environment. We will also need to ensure that those who are able to do so contribute according to their capacities and stage of development.

Some Misperceptions

Before moving on, Mr. Chairman, let me address a few specific points on which I believe there may be some misperceptions. The first of these is that the Kyoto Protocol will damage our national security or imperil the ability of our military to meet its worldwide responsibilities – this is not true.

We took special pains working with the Defense Department and the uniformed military before and in Kyoto to protect the unique position of the United States as the world's only superpower with global military responsibilities. We achieved everything they outlined as necessary to protect military operations and our national security.

At the Kyoto Conference, uniformed military representatives from the Joint Chiefs of Staff and the Office of the Deputy Under Secretary of Defense for

Environmental Security provided guidance to the delegation as we considered this issue. In the end, the Parties took a decision to exempt key overseas military activities from emissions targets, including exemptions for "bunker fuels" (those used in international aviation and maritime transport) and for emissions resulting from a wide range of multilateral operations, such as peacekeeping and humanitarian relief. This exempts from our national targets not only multilateral operations expressly authorized by the U.N. Security Council (such as Desert Storm or Bosnia), but also multilateral operations that the United States initiates pursuant to the U.N. Charter without express authorization (such as Grenada). Countries may also decide among themselves how to account for emissions relating to multilateral operations (e.g., U.S. training in another NATO country) without going through emissions trading. If any other measures to preserve our national security interests are required, and there do not appear to be any, they can be addressed through future implementing legislation. As Secretary of Defense Cohen wrote in a letter of February 24, 1998, to Congressperson Bachus, “Based on achieving our international objectives, the Department is fully satisfied with the Kyoto results.”

Second, it has been suggested that the Protocol will create a super U.N. Secretariat that will threaten U.S. sovereignty and national decision-making through alleged intrusive verification procedures and prior approval of individual emissions trades. That is not so. The review process contained in the Protocol largely codifies the existing practice under the 1992 Framework Convention, to which the United States is a Party. Under the Protocol, small expert review teams will continue to visit Annex I countries for brief periods to review implementation of the Convention and of the Protocol. The review process is intergovernmental, in that experts are nominated by governments. The review teams meet with government officials, and with others by invitation. In reviews under the Convention, the teams have met with Congressional staff, representatives of the private sector and representatives of environmental organizations – but only with their concurrence. Any other visits, such as site visits, would take place only if approved by the host country and, if the private sector is involved, the relevant interested persons. It is important to emphasize that no one can come onto the private property of a U.S. citizen without that individual’s express approval and consent. To date under the Convention, no site visits have taken place.

In addition, let me be unmistakably clear – while trading rules must be established internationally to have emissions trading work – as our SEC must set rules for equity trading – we will not accept nor do we anticipate an approach that would require prior approval of individual emissions trades by an international body. Trading will be done between interested nations and their companies, based on market principles.

Concerns have also been raised that the Protocol is flawed, on the one hand because it will threaten U.S. sovereignty by dictating national decisions on implementation and, on the other hand, because it lacks mechanisms to verify compliance. In fact we believe that the Protocol strikes an appropriate balance between these two extremes.

- The United States firmly opposed mandatory, harmonized policies and measures that would be imposed upon us in order to reach our target. We prevailed. The Protocol leaves Parties entirely free to decide how best to meet their targets based on national circumstances.

- At the same time, we could not tolerate a free-for-all where Parties might or might not meet their commitments, particularly given the conscientious way the United States meets its international obligations. As a result, the Protocol calls for national measurement of emissions, detailed reporting, and in-depth reviews – on an intergovernmental basis.

- The one area where we believe more work needs to be done is in identifying appropriate consequences for non-compliance; the Protocol provides for elaborating such consequences, with any binding consequences to be done in amendment form, so that the Senate would have the opportunity to approve them.

Finally, some have suggested that the Protocol will result in a huge government transfer of foreign aid to Russia in which we will give away taxpayer money with no leverage on Russian policies with these funds. This also is not true. Under the Protocol's emissions trading provisions, we envision that U.S. private sector firms may choose to purchase international emissions credits in order to meet their emissions obligations. Indeed, the private purchase of emissions credits is one of the crucial ways to achieve cost-effective emissions reductions for U.S. firms.

As with any market transaction, purchases of these credits will have to comply with all U.S. legal and regulatory requirements. In addition, U.S. firms interested in international investment will have an incentive to ensure that other countries meet the international standards for adequate monitoring and reporting of their emissions of greenhouse gases. At the same time, Russia will have significant incentives to use the revenue generated to invest in the most modern, climate-friendly plants and equipment so that, as its economy recovers, it continues to produce emissions credits that it can sell on international markets.

Framework for Action

Where do we go from here? While historic, the Kyoto Protocol is only one step in a long process. It is, in essence, a framework for action, a work in progress, and a number of challenges still lie ahead. We anticipate signing the Protocol within the one-year period provided for in the agreement, which runs from March 1998 to March 1999. We have not, as yet, determined the precise timing due to tactical considerations. We will sign at a time that makes the most sense in terms of the overall diplomatic situation.

In that diplomatic context, rules and procedures must be adopted to ensure that emissions trading rights, joint implementation and the Clean Development Mechanism operate efficiently and smoothly. The Kyoto Protocol establishes emissions trading, but leaves open the specifics of operations. We will work hard to ensure that the rules and procedures adopted enable emissions trading, joint implementation and the Clean Development Mechanism to work smoothly and efficiently, thereby encouraging the private sector to engage.

We will also work closely with our industries to be sure they are satisfied that the emissions trading system which is developed is as efficient and effective as possible to meet their needs.

Most significant, we must work to secure the meaningful participation of key developing countries. We must be creative in initiating bilateral agreements. We have made a promising start with an agreement we reached with China during last fall's Summit. We must also use regional and multilateral fora to achieve our objectives -- such as the Summit of the Americas process, in the Asian Partnership for Economic Cooperation (APEC) process, the President's forthcoming trip to Africa, and the G-8 Summit in the United Kingdom. We will put on a full court diplomatic press to bring developing nations into a meaningful role in helping solve the global climate challenge. We will accept nothing less, nor would we expect the United States Senate to do so As the President has indicated, the United States should not assume binding obligations under the Protocol until key developing countries meaningfully participate in meeting the challenge of climate change. Although the Kyoto Protocol was an historic step forward, more progress is necessary with respect to participation of key developing countries. It would be premature to submit the treaty to the Senate for its advice and consent to ratification at this time.

The Administration also plans to continue to work with the international financial institutions to promote market-based energy sector policies in developing countries that will help reduce developing country greenhouse gas emissions. Multilateral development bank policies, including those of the Global Environment Facility, strongly influence international lending and private capital flows for energy, industrial and transportation investments. Policies that favor market pricing, privatization, clean technologies and environmentally-friendly approaches will make implementing the Kyoto Protocol easier and will speed the growth of markets for new technologies that help reduce emissions in developing countries. We will work with the international financial institutions themselves – from the World Bank to the regional development banks – and with other countries, especially developed countries, to achieve these goals in the coming years.

The Kyoto agreement does not solve the problem of global warming, but it represents an important step in dealing with a problem that we cannot wish away. A premature decision to reject the Protocol would deprive us of the opportunity to complete its unfinished business. If we fail to take reasoned action now, our children and grandchildren will pay the price.

Mr. Chairman, before turning briefly to our domestic efforts, let me note two other key elements in this equation – the contributions that the United States provides to carry out work under the U.N. Framework Convention on Climate Change and in the Intergovernmental Panel on Climate Change (IPCC), as well as the contributions that we make to the Global Environment Facility (GEF). For FY 1999, the President has requested $314 million for the International Organizations and Programs Account, a level that represents a 6.6 percent increase over FY 1998. This amount includes $8 million for the Climate Stabilization Fund which supports the Framework Convention and the IPCC. Parties to the Convention have much work ahead of them, as I have already noted. In addition, the IPCC has now embarked on its Third Assessment Report of Climate Change, scheduled for completion in late 2000 or early 2001. These funds are vital to ensuring U.S. leadership in both of these organizations and to ensuring that our views and the work of our scientists are taken fully into account.

In addition, the President has requested $300 million to meet our past and current pledges to help fund the Global Environment Facility (GEF). The GEF helps developing countries act to protect the global environment in several key focal areas including international waters, biodiversity, climate change and depletion of the stratospheric ozone layer. If we want to bring developing countries on board with real commitments to limit greenhouse gas emissions, we need to demonstrate that we are a reliable partner by supporting their concrete efforts with reliable resources. At this point, our GEF shortfall damages U.S. credibility in promising to help developing countries meet the climate change obligations we are urging that they undertake. I would therefore urge the Congress to fund fully our $300 million request, to meet our current pledge and also clear our substantial shortfall of nearly $200 million.

President's Climate Change Technology Initiative

In his State of the Union address, President Clinton said that global warming is "the gathering crisis that requires worldwide action." We need to begin now to launch the sensible, cost-effective efforts that will help us avoid the high future cost of inaction.

The President last October outlined a three-stage approach to addressing climate change at home. The first stage consists of immediate actions to stimulate development and use of technologies that can minimize the cost of meeting U.S. goals in reducing greenhouse gas emissions. Stage two will review options created through ongoing technology development and lead to detailed plans for a domestic, market-based permit trading system for carbon emissions. Stage three will begin to implement a market-based emissions-trading system.

As a first installment on this plan, President Clinton announced in his State of the Union message two weeks ago his proposal for a $6.3 billion Climate Change Technology Initiative over five years to cut U.S. greenhouse gas emissions -- $1.3 billion higher than the President announced in his initial plan in October. This vigorous initiative calls for tax cuts coupled with research and development (R&D) to take cost-effective, practical steps that will position us well to meet the challenge we face early in the next century.

This initiative consists of two parts -- $3.6 billion in tax credits for energy-efficient purchases and renewable energy, and $2.7 billion in new R&D spending over five years.

The tax package includes tax credits of $3,000 to $4,000 for consumers who purchase advanced technology, highly fuel efficient vehicles. It provides a 15 percent credit (up to $2,000) for purchases of rooftop solar electricity and hot water systems to provide incentives for meeting the Million Solar Roofs goal. It also includes a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a $2,000 credit for purchasing energy efficient new homes, extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems.

The R&D component covers the four major carbon-emitting sectors of the economy (buildings, industry, transportation and electricity), plus carbon removal and sequestration, Federal facilities, and cross cutting analysis and research. Examples of this R&D effort include the Partnership for a New Generation of Vehicles (PNGV), a government-industry effort to develop affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In 1999, the President's budget for PNGV is $277 million, up from $227 million appropriated for 1998. Our PNGV effort is clearly paying off – the developments about higher mileage cars announced by the Big Three last month were assisted by research supported under PNGB. It is exciting to see our U.S. automakers already planning for the cars of the future, not as pipe dreams but as achievable greenhouse gas friendly products.

As General Motors Chair and CEO John F. Smith said recently in announcing GM's plans to step up research spending and focus on bringing new products to market, "No car company will be able to thrive in the 21st century if it relies solely on internal combustion engines." And as William C. Ford, Jr., Chair of Ford's Finance Committee, also said in announcing that Ford will join with Daimler-Benz of Germany in developing cars with fuel-cell engines, "There's a compelling business case to be made."

Similar government-industry efforts are proposed to develop cleaner, more efficient diesel engines for both light trucks and heavy trucks. The R&D effort also includes expanded research partnerships for key renewable technologies such as wind, photovoltaics, geothermal, biomass, and hydropower to accelerate price reductions and improve performance. The President's 1999 budget proposes a $100 million increase in appropriations for solar and renewable energy R&D – a 37 percent increase over 1998.

We hope that the Congress will view the President's initiative favorably and appropriate the funds and enact the tax incentives that he has requested. We look forward to working with you to put the President's proposals into action.

The President and his Administration are committed to working with you in the Congress, both to realize the potential of the Climate Change Technology Initiative and to craft the ongoing U.S. approach to climate change. The United States has the power to lead the global effort, and Congress holds the key. What is done or not done today will determine the kind of world we will leave to future generations and the conditions of life they will face.

Sustained Effort Required

Mr. Chairman, I have mentioned that Kyoto produced a framework for future action, and I have listed a number of the steps that await us.

Coming to grips with the threat of global warming is no small task. We must tackle it in a vigorous, sober and determined manner, understanding that it represents a challenge but also an opportunity. And as we have always done in the face of global challenge, we must assume the responsibilities of American leadership.

Thank you.

STUART E. EIZENSTAT

Under Secretary of State for Economic, Business and Agricultural Affairs

Following U.S. Senate confirmation on May 22, 1997, on June 6, 1997, Stuart E. Eizenstat was sworn in as Under Secretary of State for Economic, Business and Agricultural Affairs. The Under Secretary serves as the senior economic official at the Department of State. He advises the Secretary on international economic policy and leads the work of the Department on issues ranging from trade and aviation negotiations to bilateral relations with major partners such as Japan and the European Union. Ambassador Eizenstat retains his title and responsibilities as Special Envoy for Property Claims in Central and Eastern Europe. He likewise is a leader within the Administration in promoting democracy and human rights in Cuba.

From April 5, 1996, to June 6, 1997, Ambassador Eizenstat was Under Secretary of Commerce for International Trade. At Commerce, Under Secretary Eizenstat led the International Trade Administration, which has responsibility for promoting U.S. exports, assisting American business efforts abroad, enforcing laws against unfair foreign trade practices, and developing trade policy. He established the new Compliance Center while there, which for the first time gives the U.S. government the capacity to monitor foreign government compliance with the trade agreements they have reached with the U.S., giving us a greater assurance we are obtaining for U.S. business and workers the full benefits of the trade agreements we negotiate.

He served as U.S. Ambassador to the European Union in Brussels, Belgium, from September 1993 until April 1996. He was one of the initiators of the New Transatlantic Agenda, signed by President Clinton and European leaders in 1995, to develop closer ties between the U.S. and the European Union in the post-Cold War era, and helped develop the highly successful Transatlantic Business Dialogue, which brings together European and American business leaders to provide advice on removing impediments to transatlantic trade and investment.

In 1996, at the conclusion of his service to the European Union, Ambassador Eizenstat received from Secretary of State Warren Christopher the highest award which can be given to a non-career Ambassador, the Foreign Affairs Award for Public Service.

At the time of his nomination, he was Partner and Vice Chairman of the law firm and Chairman of the Washington office of Powell, Goldstein, Frazer & Murphy, where he had been since 1981. He concurrently served as Adjunct Lecturer at the John F. Kennedy School of Government at Harvard University, Cambridge, Massachusetts, from 1981 to 1992, teaching a course on presidential decision making, and had also been a Guest Scholar at the Brookings Institution in Washington, D.C.

From 1977 to 1981, Mr. Eizenstat served as President Carter's chief domestic policy adviser in the White House, with the position of Assistant to the President for Domestic Affairs and Policy and Executive Director of the Domestic Policy Staff. In 1976, he had joined the Carter presidential campaign full-time as Director of Issues and Policy; after the election, he became the Carter-Mondale Transition Planning Group's Director for Policy, Planning and Analysis.

His distinguished career in government began during his university years when he spent three summers (1963, 1964, and 1966) working as an intern for both the legislative and the executive branches of the Federal Government. In 1967-1968, he served as a staff aide in the Johnson White House and in 1968 as Research Director for Vice President Hubert Humphrey's presidential campaign.

From 1968 to 1970, Mr. Eizenstat worked in Atlanta as law clerk to U.S. District Court Judge Newell Edenfield, Northern District of Georgia. Since he also had been an intern in the U.S. Congress in the summer of 1963, he has worked in all three branches of the U.S. Government--legislative, judicial, and executive.

From 1970 to 1976, he was an attorney and partner of the Atlanta law firm of Powell, Goldstein, Frazer & Murphy.

From 1981 to 1993 he was the head of the firm's Washington office and Vice Chairman of the entire firm.

Ambassador Eizenstat has written extensively in leading newspapers in the U.S. and abroad, magazines, and legal, economic, and political publications, and co-edited a book, The American Agenda, a bipartisan project he co-directed to provide advice to the President-elect in 1988.

At the time of his nomination as Ambassador, Eizenstat had served on the boards of such non-profit organizations as the Weizmann Institute of Science, The Jerusalem Foundation, Brandeis University, Council on Foreign Relations, Council for Excellence in Government, Center for National Policy, the Overseas Development Council, International Management and Development Institute (Jerusalem), American Jewish Committee, and the UJA Federation of Greater Washington, and was chairman of the Feinberg Graduate School of the Weizmann Institute. He had been President of the Greater Washington Jewish Community Center from 1989 to 1991. He also was on the Board of Directors of Hercules Incorporated, PSI Energy, Inc., and the Israel Discount Bank of New York.

Stuart Eizenstat was born in Chicago, Illinois, in 1943 and was raised in Atlanta. He was all-City and Honorable Mention All-American in basketball at Henry Grady High School in Atlanta. He is an honors graduate in political science (Phi Beta Kappa in his junior year) of the University of North Carolina at Chapel Hill and received his law degree from Harvard University in 1967.

His biography appears in Who's Who in America, Who's Who in American Lawyers, Who's Who in American Jewry, Who's Who in World Jewry, Who's Who Among Intellectuals, Who's Who in American Politics, and Who's Who in the World. He has received numerous awards throughout his years in public service, including the Moral Statesman Award of the Anti-Defamation League in 1997; the Export Enhancement Award, U.S. Coalition for Employment Through Exports, 1993; Israel Bond Award, 1992; Jewish Leadership Award, the Academy of Jewish Religion, 1989; Man of the Year Award from the National Capital Association of B'nai B'rith Lodges, 1982; U.S. Department of Labor Award for Special Contributions to Youth Employment, 1980; Award from the Washington International Business Council, 1978; and Young Man of the Year Award for Leadership, American Association for Jewish Education, 1973-74.

Ambassador Eizenstat is married to Frances Carol Eizenstat and is the father of two sons, Jay and Brian.

Chairman SENSENBRENNER. Thank you very much, Mr. Eizenstat, for your very thorough testimony. We will be operating under the 5-minute rule, and if a second round of questions is necessary and time permits, then that will be the case.

CHANGES IN THE KYOTO PROTOCOL NECESSARY SO THE PRESIDENT CAN SIGN AND THE SENATE CAN RATIFY

Chairman SENSENBRENNER. Mr. Eizenstat, I think that it has been quite plain since Kyoto that the Administration considers this whole issue a work in progress. What changes in the Kyoto Protocol are necessary, number one, in order for the President to sign this Protocol, and, number two, in order for, in your opinion, the Senate to achieve the ⅔ vote to ratify it?

Mr. EIZENSTAT. It is our anticipation and expectation that we will be signing the Protocol sometime between the middle of March of this year and next year. At the same time, we know that we have the following to do, Mr. Chairman: first, we have got to make sure that the rules and procedures for trading allow inhibited market mechanisms to work. We can't have artificial constraints on that trading. That trading is essential to our capacity to meet the goals in a cost effective way. Second, we have to launch and we are launching a major diplomatic initiative to obtain the participation of developing countries. We know that the Protocol cannot be ratified nor indeed will we even submit it for ratification until we have that meaningful participation. This will take months; it may take much longer.

Chairman SENSENBRENNER. Those are the two points?

Mr. EIZENSTAT. Those are the major points. There are many other features. For example, we'll be working on the rules for the clean development mechanism. There are a whole host of other items that we'll—we'll, obviously, be trying to pass the President's own initiative on technology to jump start this. We'll be trying to develop partnerships with developing countries, but the two major features I would say are developing good rules for unimpeded trading, both international trading and the clean development mechanism, and trying to enlist the participation of developing countries.

WHEN IS THE ADMINISTRATION WILLING TO WALK AWAY FROM THE PROTOCOL AND DECLARE IT FATALLY FLAWED?

Chairman SENSENBRENNER. If the Administration is not successful in both of these areas, is the Administration willing to walk away from this process and declare it fatally flawed?

Mr. EIZENSTAT. Well, we believe that we will be successful, but——

Chairman SENSENBRENNER. Well, I'm saying if you're not successful, are you willing to walk away from it and declare it fatally flawed?

Mr. EIZENSTAT. Mr. Chairman, with all deference, I'd prefer not to speculate on something hypothetical I don't believe will occur. We know that we have to get good emissions trading, and as I've indicated in my testimony, without it, we can't achieve the objectives that we're seeking. And, clearly, without meaningful participation, we won't even submit the treaty.

TIMING OF ADMINISTRATION SIGNING OF THE PROTOCOL

Chairman SENSENBRENNER. Well, Mr. Eizenstat, you know, as both of us know having been in Kyoto, the provisions in the initial draft treaty for voluntary accession of developing countries were stricken by a Floor amendment at 2 a.m. and it will be up to the United States to try to get it re-amended to have such a mechanism either through the amendment process outlined in article 20 or the annex process in article 21. Both of them require either consensus or a ⅔ vote—excuse me, ¾ vote, and the amendment process requires at least 6-months notice before the November meeting in Buenos Aires which means we have to say what we're proposing to amend by the end of April which is not too far from now. Also, the treaty, itself, gives a window for signature, so if there is no amendment that is adopted or an annex that is adopted to the Protocol by Buenos Aires—or at Buenos Aires, March 15th will come and the treaty is unamended. Does the Administration still intend to sign it then?

Mr. EIZENSTAT. It is our expectation between now and the March 1999 deadline that we will, because we want to lock in those gains for developed countries, but that will not be a legally binding obligation of the United States of America. That will occur only when we submit for ratification, and that will be done only when we have meaningful participation by developing countries how ever long that takes.

Chairman SENSENBRENNER. Again, I'm not exactly clear, because the end of the window for signature by the President, or whoever the President's authorized a designee as, ends on March 15, 1999.

Mr. EIZENSTAT. Correct.

WHAT HAPPENS IF THE U.S. DOES NOT SIGN THE PROTOCOL BY MARCH 15, 1999?

Chairman SENSENBRENNER. Now, what happens if the United States hasn't signed it by then?

Mr. EIZENSTAT. We would not be a signatory, then, to the Protocol. It is our intention, however, that we will do so in that time frame.

Chairman SENSENBRENNER. Even if you do not succeed in achieving these two points at the Buenos Aires Conference?

Mr. EIZENSTAT. Well, again, with respect to meaningful participation by developing countries, I don't think we're going to be able to achieve that in Buenos Aires. Whether we achieve it by March of 1999 remains an open question. With respect to trading rights, that is one of the issues that is definitely on the agenda. It is embedded already in the Protocol. It's a question of simply getting the rules for it. Meaningful participation is not, unfortunately, embedded in the Protocol but trading rights is.

Chairman SENSENBRENNER. I guess my point is that we lost the opportunity for a mechanism for meaningful participation at 2 a.m. in Kyoto, and what makes anybody believe that the people who did it to us in Kyoto are going to change their mind by a 3/4 vote and agree to it in Buenos Aires?

Mr. EIZENSTAT. That's a very good question, and there's no question that we lost it, and it was a great disappointment that we lost it, because this is a global problem, and it requires a global solution.

I believe based on our experience with the developed countries where ideas that were not even known by them—like trading rights; like Sinks, like joint implementation—was adopted because of a heavy education program, that we can do the same and we intend to do the same with the developing countries.

The developing countries will have several incentives. First of all, it is in their interest to have sustainable economic growth. If they achieve 8, 10, 12 percent growth rates by wrecking their economy, they will realize, and they are beginning already to realize, that that will mean that their growth will not be, over time, sustainable. Second, they have a financial incentive and that is trading rights. They cannot trade unless they adopt binding emission targets. That will be a valuable right for them. It will be a way of transferring technology, and, therefore, there will be an incentive for them to adopt those kinds of targets. And, third, this is a question of education. It took us a while to educate, Mr. Chairman, the developed countries. It will take us a while to develop that education for the developing countries.

Chairman SENSENBRENNER. I thank you. My time has expired. The gentleman from Indiana, Mr. Roemer.

U.S. SUCCESSES AT KYOTO

Mr. ROEMER. Thank you, Mr. Chairman. Again, I want to welcome Mr. Eizenstat and commend him for his excellent and very thorough testimony.

You said in your testimony, Mr. Eizenstat, that you thought that the United States won on a host of different very important issues. You said that, certainly, we won on the differentiated targets with respect to the Europeans and the Japanese. Is that correct?

Mr. EIZENSTAT. Yes.

Mr. ROEMER. And you said that we won on the harmonized v. the flexible policies which is the top down approach v. the market approach?

Mr. EIZENSTAT. Yes.

Mr. ROEMER. And you said that we won in terms of some of the emissions trading as well too?

Mr. EIZENSTAT. Yes.

Mr. ROEMER. So, those are some significant contributions and——

Mr. EIZENSTAT. Plus our budget period and a flexible budget period at that. So, we don't have to meet our target in 1 year, and it was our budget period when others wanted an earlier budget period which would have put more strains on our economy.

Mr. ROEMER. Now, those are all pretty significant victories with respect to the positions that the Japanese and the Europeans had. One of my concerns that I alluded to in my opening statement is where we fell short with developing countries, and I guess I'd like to ask you a couple of questions about that.

MEANING OF “MEANINGFUL PARTICIPATION”

Mr. ROEMER. Is meaningful participation—does that mean that we extend the same kinds of obligations and participation to China as opposed to a Singapore or another country?

Mr. EIZENSTAT. Not necessarily. Just as we had, Congressman Roemer, differentiated targets for the developed countries, we would expect a differentiated approach for developing countries who are at very different stages of development. What is relevant for a Singapore with a $15,000, $18,000 per year per capita income might be very different from China or India or Bangladesh which has a couple of hundred dollar per capita income, and so what we're doing now is preparing a diplomatic strategy recognizing those differences but recognizing that there are really two categories of developing countries that are important.

Quite frankly, of the 160 countries, there are 120 that in terms of emissions really don't matter that much. There are 20 or so that do matter, and they matter in one of two ways: either they're big emitters like China or they have very high per capita incomes and can assume the same kinds of obligations that developed countries do. I feel particularly strongly, for example, about countries like Mexico or South Korea that are already in, or countries like Argentina and Brazil that are seeking to get in, the OACD. This is a developed industrial nation, organization. One has to meet certain tests and rules. It seems to me that if you're going to be in the industrial club, you ought to play by industrial rules.

KEY DEVELOPING COUNTRY PARTICIPANTS AND CHINA

Mr. ROEMER. Let me ask you, in terms of meaningful participation, you alluded to breaking down from 160 to—out of 160 developing nations, 120 or so and then 20. Who are the key participants in developing nations and, can an agreement be arrived at without China?

Mr. EIZENSTAT. Well, for fear that I'll omit one, I don't want to start naming all 20, but I can give you categories of countries. Countries like India and China are very important because they are very large emitters. There are developing countries that are fast approaching developed country status like some of the Asian countries like Singapore or Hong Kong; like Brazil or Argentina that are both, in the case of Argentina and Brazil, large emitters and have rising levels of income. Those are the kinds of countries that we're thinking about.

And, if I may say so, we're not doing this just on our own. Two weeks ago, I was in London for G8 meetings to try to enlist—and I think successfully so—countries like Japan and Canada and Italy and Germany and the UK in joining us in our diplomatic effort to try to get developing country participation. This will indeed be an issue for the heads of Government at the G8 meeting in Birmingham in May.

SIGNS OF SUCCESS

Mr. ROEMER. Seems to me, Mr. Eizenstat, that all your diplomatic skills and talents are going to be tested here, because you're trying to convince these developing countries that is, in fact, in their best interest to pursue this, and you're on a steep learning curve. Are you seeing any signs of success—after Buenos Aires?

Mr. EIZENSTAT. In some cases, yes. I would cite, for example, Argentina as an example. Mexico is another example. In some cases, not yet. China is an example in that category. Let me be frank—and I know that, again, Chairman Sensenbrenner saw this directly in Kyoto as did I—the developing countries, particularly, the poor ones, see this is as some kind of developed county plot to inhibit their capacity to industrialize after we've industrialized for 100 years and in their terms polluted the plant. Now, just as they're industrializing and dealing with their impoverished masses here we come saying, "Okay, we can afford this—assume these obligations, now you have to too." And we understand that.

What we have suggested is that they don't necessarily have to take the same approach to absolute reductions that developed countries have taken. They could, for example, take energy efficiency requirements that reduce the level of the increase in greenhouse gas emissions. They could do so in a variety of ways by bilateral agreements, as part of the agreement, outside the agreement. This is in their interest being more energy efficient; desubsidizing their energy so they're not subsidizing artificial energy use and then, therefore, in effect, subsidizing greenhouse gas use. All of these approaches, that's why we say, have to be differentiated depending on the country. So, again, in summary, we've made some progress with some. We have a very, in your terms, steep learning curve with others.

Mr. ROEMER. Thank you. Nice to see you again.

Mr. EIZENSTAT. Thank you.

Chairman SENSENBRENNER. The gentleman's time has expired. The gentleman from Minnesota, Mr. Gutknecht.

EVIDENCE OF GLOBAL WARMING AND MEANING OF "DISCERNIBLE HUMAN INFLUENCE"

Mr. GUTKNECHT. Thank you, Mr. Chairman, and, first of all, Mr. Eizenstat, thank you for your years of public service to our country.

Chairman SENSENBRENNER. Would the gentleman like to continue or do you want to break now?

Mr. GUTKNECHT. Why don't I continue and some of the other members can go and vote?

Chairman SENSENBRENNER. Okay. The gentleman's recognized for 5 minutes.

Mr. GUTKNECHT. Mr. Chairman, as you indicated, I represent Minnesota, and, you know, it's interesting because when we talk about the issue of global warming back home, most of my constituents say, "What wrong with that?" As you may remember, a couple of years ago we had a situation where the winter was so cold that in some parts of Minnesota you could literally take a glass of water; throw out in the air if you were outside, and it would freeze before it hit the ground. So, we've enjoyed this El Niño thing, and, frankly, we don't wish any harm to the people of California or other parts of the country, but a little warming would be a good thing for us.

I raise that because, first of all, I'm concerned that I think in general we're all sort of prisoners of hope about this whole issue of global warming and CO_2 and other greenhouse gases. When I look at these charts, what it seems to say to me is—in fact, as I look at the second chart and the blue line, we really don't see a whole lot of global warming, literally, from about the 1900's until now, and, yet, somehow in the next several years we're going to see that trend upward. I'm not certain where that evidence comes from, because I've asked some of the people from NOA if there is any real hard evidence that we see global warming especially in measurements of ocean temperatures, and they tell me that there really isn't any evidence of that at this point.

Secondly, you've used the term several times today, "discernible human influence". I'm not exactly sure what that means, and maybe you could fill in the blank on that.

Mr. EIZENSTAT. Sure. The discernible human influence is a term that was used by the intergovernmental panel of climate change, the 1995 study with the 2,000 scientists from 50 countries, and by that they mean that global warming occurs without any human conduct. It is necessary to keep our climate about 60 degrees fahrenheit warmer than it otherwise would be, but that what has happened—and this is why you get this accelerating curve—is that the human addition, particularly, since the industrial revolution is adding more and more—exponentially, adding more and more greenhouse gases to this very delicate balance where enough is taken out by absorption so that we have a very stable climate. That's being, in effect, by human conduct, that clear imbalance—that clear balance is being disturbed.

Now, over the last century, since the industrial revolution, average surface temperatures have increased about 1 degree fahrenheit, and according to the scientists in the IPCC they estimate that because of the buildup you can an exponential effect and that temperatures will increase by 2 to 6.5 degree over the next 100 years. Their best guess is somewhere in the middle, about 3.5 degrees by 2100. This would be the fastest change in 10,000 years, and these are done by computer simulations measuring the degree of buildup of greenhouse gases relative to temperatures.

Again, if I may just point you to the first chart, you notice the steep curve on the buildup. It is that steep curve on the buildup which leads to the steeper curve on temperature changes. Because the buildup is occurring faster, the temperature increase will occur faster. The buildup is occurring faster because we keep adding so much to the environment through our own human conduct, and that's why we talk about this is an insurance policy.

Now, the 11 warmest years this century have all occurred since 1980. Previously, 1995 had been the warmest until 1997; it is now the warmest. It is true that in some areas this may be a boon or seem like a boon, but it will change forest practices; it will change the whole development of our forest with ecosystems; it will have discernible changes on agricultural patterns; it will lead to dryer soil and more precipitation. There will be very major changes that will occur, and, interestingly, you mentioned that a couple of years ago it was very cold, we will have more erratic weather patterns.

Mr. GUTKNECHT. Well, let me get back to that several years ago, because we remember about 15 years ago some of the—and I don't know if they're the same scientists; we ought to get some of their names—who were predicting that we would see another ice age. I mean, it seems to me that we've had scientists who are making these predictions, and, it's like the economist, as long as they don't make them in writing, apparently, it doesn't really matter. But I do want to get to one final point——

Mr. EIZENSTAT. May I say something on that point? The IPCC has met, essentially, every 5 years. They met in 1990, and their report in 1990 was much more equivocal than it was in 1995. In 1995, they said that the balance of evidence suggested there is a discernible human interest on global climate. That's the first time they had done that, so, clearly, the scientific evidence is accumulating, and, indeed, we are learning a great deal.

Mr. GUTKNECHT. Can I get back to the point about——

Mr. EHLERS [presiding]. I'm sorry, the gentleman's time has expired, and we have Ms. Jackson Lee waiting. I presume we'll have a second round later.

Ms. JACKSON LEE. Thank you very much, and thank you for your presence here at this hearing. I have gleaned and heard the dynamics of that particular proceeding and negotiations at Kyoto, and I do want to thank you for your leadership. Obviously, there is a tension between the haves and the have nots to a certain extent.

POTENTIAL PROBLEMS OF GLOBAL WARMING AND ALLOCATION OF FY 1999 BUDGET FUNDS

Ms. JACKSON LEE. As it relates to understanding what we achieved, what we got—when I speak to constituents at home, when we try to articulate the potential problems of global warming—if you can tell me what we got, if you will, as Americans, and then, two, with the Fiscal Year 1999 budget allocations, how you will utilize that in implementing or ensuring that we are getting what we should get; that the others who have joined in with all of the potential discomfort will also follow through, how will those monies be used that are allotted in Fiscal Year 1999, and I thank you very much. And, Mr. Chairman, I'd ask unanimous consent for my statement to be submitted in the record.

Mr. EHLERS. Without objection, so ordered.

Ms. JACKSON LEE. Thank you.

Mr. EIZENSTAT. Thank you very much. What we got is an affordable insurance policy against a significant change in our climate which in turn would lead to increased flooding; which would lead to very increased levels of pollutants in the air with health costs; which would lead to a drying of soil and potential damage to our agriculture; which would lead to a planet that is subject to much more erratic and dangerous weather patterns, and which will have warming trends so substantial that there is no historical precedent for it. We achieve that at a relatively reasonable and cheap cost, but if we wait the cost will go up and go up very substantially.

What we would intend to do with the money that the President has requested, the R&D tax cut money and the money for technology, is to jump start the process of getting on the right track to correct this problem. It's developing everything from clean cars to more efficient power plants to ways in which to reduce natural gas flaring. It will release the innovative capacities of this country and employ people at the same time in doing so, and that's really the purpose of the President's initiative.

Ms. JACKSON LEE. As an affordable insurance policy, do you believe that it is enforceable? It is not a second rate or second class?

Mr. EIZENSTAT. It's a world class agreement, and in Janet Yellen's testimony, the Chairman of the Council of Economic Advisors, her estimates of cost which I would be glad to summarize are very, very modest. We're talking about 3 to 5 cents per gallon of—around 4 to 6 cents per gallon of gasoline something in that order; electricity prices, 3 to 4 percent going up. By 2012, if we act, we're talking about $14 to $23 per ton of carbon equivalent in terms of emission price. So, this is affordable, and it's also necessary. If we wait, these buildups which are scientifically determined—again, this is not projections; these are actual measurements in Hawaii and taken from ice cores—will continue to exponentially increase. The steeper that slope in the left hand chart, then the steeper will be the slope of the temperature rising, and, therefore, the more erratic the weather patterns and the more damage will be done to our very fragile environment.

Ms. JACKSON LEE. Thank you, Mr. Eizenstat. I'd appreciate a copy of that if I don't already have that statement. I'd appreciate it very much.

Mr. EHLERS. Thank you, Ms. Jackson Lee. Mrs. Morella.

Mrs. MORELLA. I'd like to make an announcement that Mr. Eizenstat is a constituent of mine.

Mr. EIZENSTAT. She knocked on my door for a vote some years ago.

Mrs. MORELLA. That's right, exactly. I'll be back, I'll be back.

Mr. EHLERS. And I hope she got it.

[Laughter.]

EMISSIONS TRADING

Mrs. MORELLA. I was going to ask you about how the trading situation is worked out. I know you have a section in your testimony on that.

Mr. EIZENSTAT. Yes, this, Madam Congresswoman, is one of the key issues that we need to decide between now and the Buenos Aires convention in November, but the essence of it is that through free market trading, as we're doing domestically with the acid rain program, companies and countries could purchase low cost permits from those countries or companies who are below their emissions budgets. It is a very cost effective way for a utility in Maryland to be able to afford to meet their burden without necessarily having, perhaps, to put another scrubber on.

COSTS OF KYOTO PROTOCOL

Mrs. MORELLA. I would like to also ask you to get back to us in terms of responding to a statement I have with regard to what the cost will be for each of our States looking at Maryland as an example that is put together by the Wharton Forecasting Association.

Mr. EIZENSTAT. Yes, we believe that Wharton did not take into account the kind of flexible market driven mechanisms we've now achieved, trading rights and so forth, which dramatically reduce costs, and the Council of Economic Advisors which just came out yesterday with this study, not even including the $20 billion in savings we get from electricity restructuring which would mitigate the full increase in cost of this which is very modest to begin with, would translate into an increase in energy prices between 2008 and 2012 at the household level of 3 to 5 percent—that's 15 years from now—an increase in fuel prices of about 5 to 9 percent; gasoline prices of 3 to 4 percent which would be about 4 to 6 cents a gallon; electricity prices of 3 to 4 percent. The average household's energy bill would increase by the Year 2010 between $70 and $100. That's in line, by the way, with the kinds of regular increases we're getting in energy prices anyway, and if you take the restructuring from the proposal on electricity that we have before the Congress, that would fully offset those costs.

COSTS OF KYOTO PROTOCOL TO MARYLAND

Mrs. MORELLA. If I could also get you to respond at some later date in terms of how you would measure, specifically, what the statement is on Maryland, I'd appreciate it.

Mr. EIZENSTAT. Sure.

Mrs. MORELLA. I've got to go vote. Thank you for being here.

Mr. BARTLETT [presiding]. Thank you, Mrs. Morella. Ms. Rivers.

IMPACT OF KYOTO PROTOCOL ON NATIONAL SOVEREIGNTY

Ms. RIVERS. Thank you, Mr. Chairman. Mr. Secretary, I have a couple of questions that really refer back to a previous hearing that we've had, and they all deal with the whole issue of national sovereignty and our rights and responsibilities under any ultimate treaty. I'm interested, in particular, there was an argument made by a witness for the Global Climate Coalition that suggested that any additional agreements to this treaty would be made as decisions of the parties to the convention and could be passed and enforced upon the United States without our agreement and Senate review. Is that true?

Mr. EIZENSTAT. Well, let me explain the amendment process. First, the Protocol, itself, strictly speaking, can't be amended before it enters into enforcement although it is possible that the conference of parties could adopt a supplementary Protocol which would be an integral part of Kyoto. Second, after entry into force of the Protocol, it can be amended pursuant, as the Chairman indicated, to article 20 of the Protocol. Under that, the parties would try to adopt the amendment by consensus, but failing that could do so by only a ¾ vote. Once adopted, however, it would not bind a party until it ratifies the amendment. So, we have a substantial number of protections.

Ms. RIVERS. So, in fact, that we could—could not be—any changes could not be enforced upon us without our agreement to those and review of the Senate.

Mr. EIZENSTAT. Exactly.

KYOTO PROTOCOL AND ROLE OF U.N. RELATIVE TO U.S. ECONOMIC GROWTH AND FOREIGN POLICY

Ms. RIVERS. Okay. The further question I have on that is this—again, this argument that the Kyoto Protocol, essentially, causes the United States to cede its powers to the United Nations in order to control our economic growth and our foreign policy. What role did the United Nations have relative to our own economic growth and our foreign policy relative to this treaty?

Mr. EIZENSTAT. It's very important to indicate—and this is why I stress it even in my brief summary—that this does not give the UN Secretariat or some UN body control over our economic future. We determine the rules for trading. Trading will be done under a free market system. Verification is done by intergovernmental groups that are already operating and have been since 1992. They've met with Congressional staff. They can't do any verification or inspection in the United States without being invited to do so by the U.S. Government. They can't come onto private property unless the property owner approves of that investigation. So, we don't have a situation here where you have some all powerful Secretariat that can command and control our economy. Quite the contrary, that's why we insisted on flexible market driven mechanisms to achieve these results.

KYOTO PROTOCOL IMPACT ON U.S. MILITARY MISSIONS OR NATIONAL SECURITY

Ms. RIVERS. Okay, and to follow up on that, I would also like to hear your comments on how, if at all, this agreement would impact on our ability as a Nation to carry out any military mission or protect our national security?

Mr. EIZENSTAT. The military issue is one that was our—one of our greatest goals, and if I may so, one of our greatest achievements. We were able to exempt overseas military activities from emissions targets. We were able to exempt so-called bunker fuels which our military relies on. We were able to exempt multilateral operations that are expressly authorized by the UN Security Council, and we were able to exempt multilateral operations like Grenada that are only done pursuant to the charter but not expressly authorized. So, we really met the objectives our military had. I had a very excellent relationship in Kyoto with the uniformed military who had representatives on our negotiating team, and, as Secretary Cohen in the February 24th letter—and I'm quoting—"based on achieving our international objectives, the Department's fully satisfied with the Kyoto results."

CONSEQUENCES OF FAILURE TO MEET KYOTO PROTOCOL TARGETS

Ms. RIVERS. Lastly, if we fail to meet our required targets—if we agree to this treaty, ultimately, whatever form it takes, and we fail to meet our required target, what happens and who does it?

Mr. EIZENSTAT. That's a very good question. At this point, there is only the following sanction: countries that fail to meet their targets cannot participate in joint implementation with credit-type projects. We had also hoped to get in even stronger sanctions. For example, that you couldn't do emissions trading, international emissions trading. That was not accepted, but it was accepted that if you don't meet your targets that you cannot participate in the clean development mechanism which is the joint implementation with credits.

Ms. RIVERS. Thank you, Mr. Eizenstat. Thank you, Mr. Chairman.

Chairman SENSENBRENNER. The gentlewoman's time has expired. The gentleman from Maryland, Mr. Bartlett.

Mr. BARTLETT. Mr. Chairman, if you will indicate when my time has expired——

Chairman SENSENBRENNER. You'll hear a little beep.

Mr. BARTLETT [continuing]. And if we'll have time for a second round, and I will continue my questioning at the second round, if I have not finished. Thank you very much.

HOW DO WE KNOW THAT CO_2 CAUSES GLOBAL WARMING?

Let me return, Mr. Eizenstat, to the science part of it.

You have demonstrated in your charts an approximate correlation between CO_2 and temperature, although, I note that between 1825 and 1850 while CO_2 is static or going up, temperatures are falling, so that would appear not to be a really positive correlation, but even, sir, if there is a positive correlation, how do we determine cause and effect. Two things that are positively correlated could both be the effect of another cause or either one could cause—could be the cause and the effect. Why isn't reasonable to assume that increasing temperatures would increase life activity? There will be a balance between animals which produce CO_2 and plants which use CO_2, and you could, therefore, postulate that with rising Earth temperatures you would have either an increase or a decrease in CO_2 depending upon the relationship between the animals and plants? So, I'm not sure that we know for sure that rising CO_2 increases temperatures.

HOW DO WE KNOW THAT WE ARE TRULY WARMING RATHER THAN HEADING INTO AN ICE AGE?

Our Earth in the past has been both very much colder—we have had ice ages with glaciers as far south as southeastern Ohio. We also have had a globe which is very much warmer. We still can find mastodons frozen in the tundra with subtropical vegetation in their stomach indicating that we had a very much warmer Earth at that time. And, also, as you go from warming to cooling or vice versa, there will be little ups and downs as you are going up or down. How we can be sure that the very modest warming we've had now, most of which has occurred before real industrialization—the increase over the last century—how can we be sure that we're not simply on a little upswing on what is generally a down swing, and we are, in fact, heading to an ice age?

Mr. EIZENSTAT. The scientific data indicates, first of all, very unmistakenly, that the concentrations of CO_2 are dramatically increasing and that this adaptability which you refer to is, in fact, not occurring, and that's the dramatic evidence in that chart. I mean, it's just unmistakable. These are actual readings of CO_2 concentrations, and they are increasing at a dramatic rate, and the slope demonstrates that. Second, there has been, according to actual measurements, a 1 percent fahrenheit increase in temperature since the industrial revolution. And, last, according the computer simulations and calculations of physicists and mathematicians that's embodied in this 1995 intergovernmental panel on climate change report which brought together the 2,000 world leading climate scientists, this correlation between buildup of CO_2 gases—which, again, is absolutely measurable—and the temperature variation which that will produce is, they indicate, clear.

WHY WOULDN'T WE BE HAPPY WITH A MODEST CO_2 INCREASE?

Mr. BARTLETT. When CO_2 is produced, pollutants are also produced. Carl Sagan warned us of what he called a nuclear winter in the event of a nuclear war which would drastically reduce temperatures. It's very difficult to produce CO_2 without producing pollutants, other pollutants—I'm not really sure if CO_2 is a pollutant—but producing other pollutants which could either warm or cool our globe depending upon whether they let in more or less energy from the sun and whether they reflected more or less energy.

The sun comes in over a wide spectrum of wavelengths. When it has warmed up the Earth we then reflect back only in long wavelengths which can be easily flawed. So, I'm not sure whether increasing CO_2 temperatures will increase—increasing CO_2 concentrations will increase the temperature of the Earth or not because of all of the other factors.

So, in the future, we're going to face the problem of producing enough food for our increasing population. Plants now live on the ragged edge. Only .04 percent CO_2. They like more CO_2 and grow faster and better. From that perspective, why wouldn't we be happy with a modest CO_2 increase?

Mr. EIZENSTAT. Because it will have discernible impacts around the globe that will be very negative. For example, in terms of absorption, they'll be much heavier precipitation which will have a negative impact, in some cases, in agriculture, and we'll have much drier soils because of the absorption that will occur, and so the capacity of some countries to produce agricultural products will be severely impacted.

It is true that in some areas there will be an increase in agriculture; in others there will not, and as Secretary Romeger indicated in testimony today before the Senate Agriculture Committee, the more discernible impacts will be on forests probably than on agriculture, and, there will be very severe changes in forest patterns.

Chairman SENSENBRENNER. The gentleman's time has expired. The gentleman from Pennsylvania, Mr. English.

ECONOMIC IMPACT OF KYOTO PROTOCOL ON PENNSYLVANIA

Mr. ENGLISH. Thank you, Mr. Chairman. I appreciate the opportunity to appear here. Secretary Eizenstat, it's certainly a privilege to have someone of your long service and caliber here before the Committee and in a position to, perhaps, answer a couple of questions.

I am very concerned about the economic impact of this treaty on my home State of Pennsylvania. You're very familiar with our unique combination of heavy industry; our concern with a variety of emissions issues and not just this one. I'm concerned that a study by Wharton Econometrics has predicted a very substantial economic impact for Pennsylvania, and I'd like to comment a little bit on their findings and get your response on the strength of their interpretation of the treaty.

They have predicted 32,200 job losses for Pennsylvania if this is implemented including 22,000 manufacturing jobs, and I have, perhaps, the biggest concentration of manufacturing in the State in my District, so that gets my attention. They have predicted that it would lower Pennsylvania's wages between 2.8 percent and 1.5 percent which is cumulatively a substantial impact. It would mean higher energy costs, and, therefore, higher grocery, housing, and medical costs, and they predict a cost per year of roughly $255 per person. Can you do anything to dispel that gloomy picture out of Wharton?

Mr. EIZENSTAT. Yes, sir, absolutely, because that gloomy picture does not take into account the kinds of flexible mechanisms including trading that we have that would, in a major way, reduce the costs. Janet Yellen is not here to give her full testimony. Hopefully, she will be invited to do, so you can go into this in more detail but, again, if I may just summarize the testimony that she's given which indicates a very modest cost—and that's why we say this is an affordable insurance policy.

She suggests that the total cost of attaining targets with the kinds of flexible market mechanisms that we have built in would amount to about $7 billion to $12 billion a year in the period 2008 to 2012. This implies that overall costs excluding the benefits that you get from climate change initiatives, and this would be—you talk, Congressman Bartlett about pollutants—you'd have less pollutants, less asthma, less problems of a health kind.

Also, even excluding cost mitigating factors like Sinks and the President's electricity restructuring program she estimates would reach roughly only 1⁄10 of 1 percent of projected GDP in 2010, and that—as I indicated, I think before you came in—we're talking about emissions prices of $14 to $23 per ton; an increase in fuel oil prices over this 15-year period of only 5 to 9 percent; gasoline prices 3 to 4 percent; average household energy bills over that whole period, only between $70 and $110 per year.

Mr. ENGLISH. Mr. Secretary, do you have anything specifically applies that analysis to Pennsylvania?

Mr. EIZENSTAT. I don't believe that the Council of Economic Advisors has done State-by-State breakdowns, but we'll be glad to supply Chairman Yellen's testimony which is the most definitive statement we have on this.

MEXICO'S AND OTHER DEVELOPING COUNTRIES' WILLINGNESS TO PARTICIPATE IN AND SHARE IN THE REGULATORY BURDENS

Mr. ENGLISH. I would be grateful for that. I have one follow up question if I have time. And that is, as you probably know, Pennsylvania has the largest concentration of trade adjustment assistant claims relative to Mexico of any State in the Union. Needless to say, we are very concerned about the impact of NAFTA, and there has been some public dissatisfaction of the Administration's enthusiasm for NAFTA. I am very concerned that this treaty does not apply similar restraints and similar regulatory burdens to a number of "developing," countries including Mexico; including China; including India, and our concern, frankly, is that this creates an enormous regulatory burden imbalance which will have the effect of shipping more jobs than we already have to Mexico. I realize the Administration has made public statements to the effect that they will be seeking to engage these countries, but so far they have been resistant.

May I ask you, do you have any confidence and can you give us any confidence that Mexico is going to be willing to participate and share in the regulatory burden in a way that they haven't, for example, under the labor and environmental side agreements?

Mr. EIZENSTAT. Let me respond to your question, which is well taken, in two ways. First of all, we do not intend to have the United States of America bound by law, which means Senate ratification, unless and until we do get meaningful participation by key developing countries. Second, with respect to Mexico, in particular, Mexico, Argentina, several of the central and Latin American countries were the most interested in participating, and we believe through our bilateral relationships that they will be increasingly be so.

I mentioned—I think, perhaps, before you came in, Congressman English—that I feel quite strongly that a country like Mexico or South Korea that's in the OECD or Argentina that wishes to be in the OECD ought to assume the kinds of obligations that go with that kind of membership, and that's the kind of effort we're going to be urging on them. So, I do think that we're going to see real participation by Mexico, and that will be one of our clear targets of opportunity.

Mr. ENGLISH. Thank you for your illumination, Mr. Secretary, and thank you for your patience, Mr. Chairman.

Chairman SENSENBRENNER. Well, you're very welcome, Mr. English. The gentleman from Michigan, Mr. Ehlers.

SEPARATING FACTS FROM CONCLUSIONS

Mr. EHLERS. Thank you, Mr. Chairman. A number of comments, perhaps a few questions. I thank you for being here, Mr. Secretary, and some of my comments are going to be about the science involved, and I apologize for burdening you with that, but the other two hearings that we had on this topic I had to leave before question period, and I just wanted to make these points.

As a scientist myself, I like to separate the facts from conclusions, and I think—well, let me list a few facts first. First of all, CO_2 is increasing in the atmosphere. I don't think there's too much question of that. I am curious why we don't have a worldwide average there rather than just Mauna Loa. I think it's worth looking at it throughout the country—throughout the world and not just one location. But CO_2 is increasing, and I would also mention that methane is increasing, which is far more of a problem in terms of its retention of heat in the atmosphere than CO_2 is.

A second fact: this does result in increased energy being retained in our biosphere, and I don't believe there's too much question about that; greenhouse gases do retain energy here. I also will concede another fact in your area of economics rather than my area of science, and that is that market-based emission trading does seem to work quite well.

Now, the conclusions, however, I think that you seem to hold very affirmatively, I believe are subject to question. For example, global warming, if you look at the graph on the right, which you referred to a number of times, it's very hard to discern any observable pattern up to this point, and we may well speculate that the temperature's going to go up in the future. But there's considerable controversy about that, and it certainly is not at all evident from the graph there. As you can see, it's relatively flat for the past couple of centuries with lots of squiggles. So, I think we have to be very careful about assuming that the energy that's being dumped in and retained in the biosphere is going to manifest itself as temperature increase.

ARE THE GLOBAL CLIMATE EFFECTS GOOD OR BAD?

Mr. EHLERS. I think—and there is a lot of uncertainty here—but I think it's far better to talk about global climate effects rather than global warming. Then the question is what are the climate effects? And, there, I believe there is even greater uncertainty than there is with the warming effect. The further assumption you seem to make is that the climate effects would necessarily be bad. And since I'm very conservative in my thinking I share your concern that they might be bad. But, again, that's not a foregone conclusion, because the climatic system is so incredibly complex. Just take, for example, the impact of El Niño, which is fairly well known after this year. Florida experienced some terrible tornadoes of much greater intensity than they normally have, and this is blamed on El Niño, and that's terrible. At the same time, the climate change as a result of El Niño spared them from hurricanes. Last hurricane season, they had very little difficulty, and I'm just giving that example to illustrate how difficult it is to predict whether the effects on climate are going to be good or bad. The effects of El Niño in Florida are both good and bad and in this particular case I suspect the good outweighed the bad. That's not true of California where they have had very severe storms, and they have not received much benefits. In the Midwest, it's been an absolutely wonderful winter except for those who like winter sports. It's been very warm; our snowfall in Michigan has been only 40 inches for the year, which is high by Washington's standards, but about half the normal. It's been a wonderful winter yet, we may have a drought next summer as a result of El Niño. Again, very complex and it's hard to determine whether it's good or bad.

My point of all this is it's very difficult—even though we can agree on the facts about CO_2, methane, and so forth—it's very difficult to determine how this is going to manifest itself in climate and whether it's good and bad, and then also it creates great uncertainty in what to do about CO_2 and how to resolve that.

EXCLUSION OF DEVELOPING COUNTRIES FROM KYOTO PROTOCOL REQUIREMENTS

Mr. EHLERS. One last point I'd make—this is political rather than strictly scientific, although, there's some science with it as well—I think it is a grave mistake to exclude the developing nations from the requirements. And I say that with considerable hesitation, because I have served on several task forces and I've chaired one dealing with the problems of developing nations, particularly, the issue of world hunger, and I sympathize with the need for them to develop their economies. However, the difficulty to get into it, if you exclude them at this point—and they are at a point where they are, in fact, developing; they're developing their industry; they're developing their energy sources—they are likely to install sources that are going to result in substantial emissions.

Even if we, for some reason, cannot impose requirements on them now, I would hope for you to make it clear in writing that they will have to meet certain requirements within a certain time span, and for the simple reason—I'm almost there, Mr. Chairman—for the simple reason that the decisions they make now as to which kind of power plants to put in and what time; what other equipment to get has to be colored by the fact that they have to buy low-emission equipment now. Otherwise, we will face the problem 10 to 15 years from now, and they will say, "I'm sorry, we've got all this and we can't afford to change it." I'm sorry for overrunning my time, and I just wanted to register all those points and I hope that you factor those into your thinking as you continue to work on this.

Mr. EIZENSTAT. Do I have time to answer that?

Chairman SENSENBRENNER. Of course you do.

Mr. EIZENSTAT. Okay.

[Laughter.]

Chairman SENSENBRENNER. Hopefully, briefer than the question.

[Laughter.]

Mr. EHLERS. No, the question was brief, the statement was long.

Mr. EIZENSTAT. I thought it was a yes-or-no answer, Mr. Chairman.

First of all, I very much appreciate the erudite quality of your statement and Congressman Bartlett's. It's obvious that you've given a lot of thought to this.

But let me respond in a couple of ways. First of all, I couldn't agree with you more on the developing country piece. They are going to be installing the next generation of power plants; the next generation of industrial plants, and it's important that we catch them at this point, because, otherwise, they'll say, "Well, we've just put in the next generation, and it will be another 15 years before we can do anything." So, there is an urgency to our trying to get the developing countries in, and that's why the President has said he simply won't bind this country to binding obligations unless and until we get this meaningful participation. So, that I agree with you.

Number two, obviously, I agree with you on the degree that CO_2 is increasing; that it is, in fact, attracting greenhouse—that greenhouse gases are being trapped. I think where I would, perhaps, depart a bit is in terms of the likely effects. Here, we do have a 1-percent increase in temperature over the last 100 years since the industrial revolution. Second, we have very clear computer simulations indicating the relationship between this buildup in concentration which is dramatically increasing as you, yourself, indicated, and the likely temperature effects. Now, what you said is, "Well, that is not certain. You can't be sure that it will lead to warming or even climatic effects." But the computer simulations are there, and what I would challenge you—and I don't mean this personally but you as a collective body in the Congress and all of us, and that's why we call it an insurance policy—on which side would you prefer to err?

We've got this growing body of evidence about the concentrations; we've got the computer simulations. The kinds of policies that we're talking about are, in any event, good energy policy. They're good in terms of efficiency. If we wake up 10 or 15 years from now and this trend which the computer projections indicate is, indeed, happening, we'll be in a hell of a fix. The costs will be much more expensive, much more dramatic, and that's why we say let's act now; let's take out a reasonable policy with a reasonable premium. Let's begin to make some decisions. I mean, this doesn't go into effect until 2008 to 2012, but these concentration increases, and, as you know, as a scientist, there's a lag, I'm told, of about 20 to 30 years between emissions which are already occurring today and tomorrow and the next day in the concentration and temperature increases. So, if you assume that there is a lag of 20 or 30 years, then by not acting now we will have assigned ourselves to go down what could be—certainly given the scientific data we have, we're much more, I think, likely to take the right fork in the road if we begin these modest policies—nobody's talking about choking off the economy. We pass the President's tax credits. We get our technology initiative going. We work on getting emissions trading off the ground. We work on getting developing countries involved.

Just think if we sat back—I mean, under your own scenario where you talk about the next generation, suppose we just sat back and we said, well, not a problem; go ahead and build all the coal-fired plants without the latest technologies, and we'll come back 15 years from now and see what happens. That would be, by your own statement, I think a definition for a really catastrophic event.

We want to engage in that. We need to engage in that. It may take years to get them engaged, but, Lord knows, if we don't start now, it will be much more costly and much more difficult to engage them later.

Chairman SENSENBRENNER. I think we do need a second round of questions, and I'll start off.

Secretary Eizenstat, I'd like to get us back to discussing the Protocol that you signed in Kyoto rather than a whole bunch of hypotheticals or suppositions that you just said in response to Mr. Ehlers question.

ABILITY TO AMEND THE KYOTO PROTOCOL

Chairman SENSENBRENNER. Mrs. Rivers from Michigan asked some questions. You said, in response, in part, that this Protocol can't be amended until it goes into force. And Article 25.1 says that it goes into force on the 90th day after the date on which not less than 55 parties, incorporating parties, including Annex 1, which accounted for at least 55 percent of the total CO_2 emissions in 1990, have signed, ratified, and deposited their instruments of acceptance.

Now since you have said that we've got to have some amendments relative to LDC participation, as well as clarifications, whether it rises to an amendment or whether it means an annex to the Protocol, isn't the United States stuck, since it can't propose amendments until the treaty comes into force, in having to deal with this treaty as you signed it until we can get amendments adopted, either by the consensus mechanism or by the three-quarters vote mechanism in Articles 20 and 21?

Mr. EIZENSTAT. Not necessarily. For example——

Chairman SENSENBRENNER. Then why not necessarily?

Mr. EIZENSTAT. Because we can get a supplemental Protocol passed that would be included in Kyoto. That is one——

Chairman SENSENBRENNER. And under what mechanism would that be? Would that be the consensus mechanism that we had in Kyoto or would it be some other mechanism?

Mr. EIZENSTAT. It would probably have to be out of the consensus mechanism.

Chairman SENSENBRENNER. And since the LDCs were so successful in knocking out even voluntary ascension with that famous floor amendment that I have referred to a couple of times, what makes you believe that LDCs like China and India would completely reverse a very hard position that they took in Kyoto, in Bonn, and in Berlin, that they were not interested in getting onboard this Protocol?

Mr. EIZENSTAT. I think there is no such certainty. One cannot be certain that they would reverse themselves. I think this is going to be, again, a learning curve for them, and we hope that we can achieve it, but we certainly can't guarantee it.

IF THE ADMINISTRATION FAILS TO AMEND THE KYOTO PROTOCOL, IS IT PREPARED TO WALK AWAY AND DECLARE IT FATALLY FLAWED?

Chairman SENSENBRENNER. And if we fail in this like we failed in Kyoto, then is the Administration prepared to walk away from this process and state that it's fatally flawed?

Mr. EIZENSTAT. Well, we've no reason to walk away from the process——

Chairman SENSENBRENNER. Why? We've lost once; we've lost twice.

Mr. EIZENSTAT. No, sir. Because we have won, first of all—and I don't want to just be repetitive—all the things that I've talked about, we've got for developing countries, reasonable reduction rates that are competitive with our competitors, the flexible marketplace mechanisms—all of those things are embedded in this agreement. We don't want to walk away from that.

Chairman SENSENBRENNER. But, Mr. Eizenstat——

Mr. EIZENSTAT. Wait a minute.

INCENTIVES FOR EUROPEAN AND DEVELOPING COUNTRIES TO AGREE TO EMISSIONS TRADING RULES DESIRED BY THE UNITED STATES

Chairman SENSENBRENNER. You said yourself that the emissions mechanism is subject to further definition and clarification at Buenos Aires or at some other place. What happened is that we gave the EU almost complete unfettered emissions trading within the membership of the EU, and then we disadvantaged ourselves where we do not have the emissions trading with ourselves, the

Russians, the Japanese, the Ukrainians, the Australians, the New Zealanders, the so-called "jusscannz" countries. So what incentive is there for either the Europeans or the LDC nations to agree to give us the type of emissions trading that they gave themselves with American acceptance at Kyoto?

Mr. EIZENSTAT. I think two things. First of all, the Europeans themselves have told us—they've told me personally—that they want emissions trading outside their bubble. They want to be able to trade just as much as we want to be able to trade. So they have an incentive to make that efficient, and they've told me—again, this is coming from the UC or representatives from the UK, from other countries in the European Union—that they want to be able to do so——

THE KYOTO PROTOCOL: A WORK IN PROGRESS OR A FINISHED PRODUCT?

Chairman SENSENBRENNER. But this gets us back that if we don't succeed in that, we are stuck with a treaty which you signed on behalf of the United——

Mr. EIZENSTAT. I didn't sign any treaty.

Chairman SENSENBRENNER. Well, you agreed to on behalf of the United States in Kyoto. And since it's apparent from your testimony that the Administration does not want to face the fact of walking away from this process, then we are kind of caught with something that we agreed to, but which we don't like and which we think needs to be amended, but which has to go into force before we can even propose amendments.

Mr. EIZENSTAT. We will not be binding ourselves legally, even if we sign it. Signing it is a way of indicating that for this first step we've taken a first step; we want to solidify, but we have no binding obligations whatsoever until there is a second step, and that second step is the developing country participation. However long that effort takes, we should pursue it.

I mean, again, Congressman Ehlers said it as well as anybody can—in the sense that they are putting in this next generation. We want to have an impact now on what they do, and we won't have that impact if we walk away from the process.

Chairman SENSENBRENNER. But, you know, I practiced law in a small town, and when you agree to a contract, and eventually sign it—you've said that this is going to be signed by March 15th of next year—then that's a deal unless you get the parties to agree to modify the deal. Now you heard from the Chinese with their intransigence just as much as our delegation heard from the Chinese. If they end up preventing consensus from taking place, then we're stuck with a deal that you have said is an incomplete one.

What are our alternatives as a country, either to be stuck with a deal and try to change it, no matter how frustrating or how unsuccessful we may be, or walk away from it?

Mr. EIZENSTAT. I practiced law, too, in a large city, and the contracts are the same in small cities as in large cities. This would be what I would call, at best, a conditional contract or statement of principles. Every country in the world realizes that every other country has to go through its ratification process. Signing is not legally binding any country. The Parliament in the UK is going to pass it, for example.

Chairman SENSENBRENNER. But their process is different because the government is in the majority.

Mr. EIZENSTAT. That's correct, and we're not going to do it—we're not going to even submit it, not because of whether the Republicans or Democrats control Congress, but because the Congress—the Senate has said 95 to 0 a very clear statement, and it, by the way, is a statement we agreed to. That is, that you have to get developing countries involved in this process before we will bind ourselves.

Chairman SENSENBRENNER. And if we agreed with it, then why didn't you say at 2 a.m. when this amendment was being rammed through, that this is a deal-breaker and walk out?

Mr. EIZENSTAT. Well, we said a lot of unprintable things at 2 a.m. when that happened, I must say, but——

Chairman SENSENBRENNER. How about meaning that one?

Mr. EIZENSTAT. But the reason we didn't walk away from the process is because we had already achieved so much else, No. 1, and, No. 2, because we said we want everybody to be on notice, the United States is not going to legally bind itself unless and until you play in this game. If you don't play, we don't legally bind ourselves.

Chairman SENSENBRENNER. But you've announced that you're not going to walk away from the process. So——

Mr. EIZENSTAT. We want to have an influence on the process, Mr. Chairman. We will lose our influence on the developing countries, we'll lose our influence on the capacity to get good trading rights, if we take our marbles and walk home.

Chairman SENSENBRENNER. Well, without the developing country participation, our marbles are never going to be in play because you and I both know that the Senate isn't going to ratify it after a 95-to-nothing vote.

Mr. EIZENSTAT. Not only will they not ratify it, we won't even submit it.

Chairman SENSENBRENNER. I thank the Secretary.

The gentleman from Maryland.

Mr. BARTLETT. Thank you, Mr. Chairman.

GLOBAL WARMING OR GLOBAL COOLING?

Mr. BARTLETT. I'd like to return, as the second scientist in Congress, to a discussion of some of the scientific aspects of this. I think from a scientific perspective, we can't be sure that we are moving toward general global warming or moving toward another ice age. You could argue both of those. As a matter of fact, about 20 years ago, the same people arguing for global warming were contending we were moving to an ice age.

Mr. EIZENSTAT. Neither one is a terribly attractive option, if I may say so.

Mr. BARTLETT. That is correct, sir, and it may be that these are simply some little instabilities and we are not moving in either direction. If we're moving to a modest global warming, then I think, clearly, our world would be different. I think you would be hard-pressed to say that it would be worse, since in the past we have had a world which is both very much cooler and very much warmer. I think that Canada and Russia might benefit from a little global warming. Our cornbelt would move north. Clearly, we would have changes, and I'm not sure that we could now say that we would have a better or a worse world because of that.

ENERGY EFFICIENCY AND FOSSIL FUELS

Mr. BARTLETT. You mentioned energy efficiency, and I think, sir, that there may be another approach that one could use in achieving the same objectives that you want to achieve, and it is by looking at where we get our CO_2. Most of it comes from fossil fuels. Fossil fuels are not forever. We do not have a limitless supply of fossil fuels. We have an enormous petrochemical industry that uses fossil fuels; in large measure, one could say that oil, and particularly gas, are too good to burn because they form the basis of a very large and important petrochemical industry.

If we were predicating our energy efficiency initiatives on the basis that this was necessary in order to one day, and maybe sooner or later, depending on who you talk to, run out of fossil fuels, which brings us to a very uncertain energy future in the world, I think you might have a more usable argument that you could get more people onboard. You'd meet exactly the same objectives, but you're riding a different horse and an easier one to sell, I think, to get there.

Mr. EIZENSTAT. Okay, let me respond to both. First, in terms of not making things worse, I think if I may say so, with all deference, that is simply not the case. A warmer Earth would speed up the global water cycle—the exchange of water among the oceans, atmospheres, and the land. Higher temperatures would cause more evaporation. The soils would tend to dry out faster. Increased amounts of water in the atmosphere would need more rain or snow overall.

In addition, we have already measured an increase of 4 to 10 inches over the last 100 years in the mean sea level. Because global warming will increase sea level concentrations, sea levels even more, for two reasons—first, because simply water expands when heated, but also because discernible, measurable melting of glaciers is occuring—this will put low-lying areas at risk.

I think it was you, Congressman Bartlett, that mentioned—if not, it was perhaps Congressman Ehlers—the methane problem with formerly frozen soils, the perma-frost in Alaska and the Siberian Arctics have already begun to melt. Again, this is measurable. This is scientific. This will damage ecosystems and infrastructures, but it also will release more methane.

There also would be a human health problem. This warming with exacerbate air quality problems. You, yourself, talked about the increased pollutants. Diseases that thrive in warmer climates, like malaria and yellow fever, would increase. It's been estimated by scientists, by the end of the next century, that there will be an additional 50 to 80 million cases of malaria each year that this climate change continued unabated. So these are all measurable.

One other thing is in terms of evidence. Between 1981 and 1991, the length of the growing season in the northern high latitudes increased by a total of up to 12 days, while in other areas that has not occurred. So there really are measurable, discernible activities which are occurring. We think, on balance, they would be more negative than they would be positive.

Mr. BARTLETT. That's a supposition we don't know for sure, but I think that achieving energy efficiency through the incentive of husbanding our finite supplies of fossil fuels is a very saleable idea.

Mr. EIZENSTAT. May I just say on the fossil fuel thing, going back to my earliest days in government, when I was working at the Carter White House on the energy policies there, one of the things that we—let me make two points. No. 1, we underestimated the amount of fossil fuels that this planet has. We keep discovering more in the North Sea and more in China and more in the Kaspian Basin, and so forth. That aside, there obviously is a finite amount that the good Lord put on this planet. The steps that we're suggesting taking here will have the benefit of reducing our dependence on fossil fuels, and that, in and of itself, as you just indicated very eloquently, is a real benefit.

If none of this ever occurred, if this all tends to be inaccurate, the steps we're taking will have a discernibly positive benefit in terms of reducing our dependence on imported oil, for example, which will help our trade deficit, and it will prolong the period of time we have fossil fuels on the Earth. So there is a discernible benefit.

I would turn it the other way. If we don't act and you turn out to be incorrect, then we would have an irreversible situation.

Chairman SENSENBRENNER. The gentleman's time has expired.

The gentleman from Illinois, Mr. Ewing, has not had a chance yet.

Mr. EWING. Thank you, Mr. Chairman.

A number of very interesting comments: You indicated that we were wrong in the amount of fossil fuel on this planet, our scientists——

Mr. EIZENSTAT. Not scientists, policymakers. When we were developing our energy policy in the 1970's, we were told by a number of estimates that the demand-and-supply curves were going to cross in 1985, and instead, we found a lot more fossil fuels and energy than we thought.

Mr. EWING. Well, I do think that points out the fallibility of the Federal Government's estimating any of these, whether they do it with scientists or bureaucrats, or whoever. You made the comment that, by implementing the treaty, we would have a lot of positive benefits, correct, even if the global warming wasn't a problem?

Mr. EIZENSTAT. Yes, sir.

ECONOMIC IMPACT OF THE KYOTO PROTOCOL ON ILLINOIS

Mr. EWING. Okay. How does that match up with our projections? They could be wrong. One hundred and eighty thousand jobs could be lost in Illinois. We would lower our ranges between 3.1 and 2 percent. Now, you know, all this lowering of the trade deficit—we'd lower the trade deficit, I'm sure, because without those jobs, we're not going to be buying foreign products. When you damage the economy, even a fraction of that amount, you have done major damage that I think offsets these possible benefits, even if you're wrong in the global warming.

Mr. EIZENSTAT. Congressman Ewing, first of all, the estimates you made that I suggested in terms of warming and trends is not done by the Federal Government. The most definitive judgment was made by an intergovernmental panel, scientists, private scientists generally, 2,000 scientists from 50 different countries; plus, the fact that Federal Government people are human beings as well.

Second, with respect to the estimates——

Mr. EWING. What did you mean by that, sir?

Mr. EIZENSTAT. That, in other words, the scientists working for EPA have oftentimes very good judgment as well, even as good as one not working for EPA. But the judgments we're giving you are not based on Federal Government——

Mr. EWING. Well, you don't need—please don't lecture me on that. I can tell you——

Mr. EIZENSTAT. I'm not lecturing you on anything. I'm just saying that——

Mr. EWING. You are—you are, indeed, promoting the policy of this Administration, whether it's backed up scientifically or not.

Mr. EIZENSTAT. I would hope I'm promoting—sir, that's what I'm paid for.

Mr. EWING. That's right. Well, let's just have that on the table, so we all know who's paycheck and where it comes from. I'm paid for by the people I represent.

Mr. EIZENSTAT. I appreciate that and I respect that very much.

Mr. EWING. Thank you.

Mr. EIZENSTAT. And I'd like to then get to the question of the people that you represent. The estimates that you have given we think are not, indeed, accurate because they don't take into account what we were able to achieve in Kyoto in terms of cost-reducing measures, like emissions trading, that substantially reduce the cost. We just released our own estimate yesterday, Congressman Ewing, of the costs of global warming with what we got in Kyoto, and that amounts, as I've mentioned several times—and I don't want to be repetitive to the others who were here before—of $7 to $12 billion per year. It translates into very small increases in energy prices and in gasoline prices, and an increase in household energy bills at 2010 of around $70 to $110 per year, and that would be offset almost fully if the Congress passed the electricity restructuring and deregulation proposals we've suggested.

In addition, the Chairman mentioned at the beginning the sort of gloom-and-doomers, and so forth. I tried to be as calm and as candid as I can about the situation here. I'm not being hyperbolic. I'm not being Chicken Little, but over the years, over the last 15 or 20 years, at every turn when there's been an effort to pass the Clean Water Act or the Clean Air Act or to deal with the ozone problem, we've always been told that we can't afford it; that it will wreck the economy. We've got an economy that is the envy of the world. We created 15 million jobs over the last five years. Europe has created, with a larger workforce, about 2 million jobs. We've got the lowest unemployment rate in 25 years. We are, I can assure you—and I think you know this from your own observations—we literally are the envy of the developed and developing world, and we've done it while also improving our environment.

We believe, Congressman Ewing, we can do the same thing and that a lot of the way we'll achieve this, in Illinois as well, which is a great industrial heartland, but also a great heartland for high tech—I was born in Chicago; my family lives in Chicago. Chicago is a great center for high tech. The kind of technologies which Texaco has been talking about, which Jack Smith from GM has been talking about in terms of a whole new generation of new cars that can get twice the gas mileage—this is going to release a tremendous outburst of U.S. technology which will mean more jobs and more improvement for the people of Illinois.

Chairman SENSENBRENNER. The gentleman's time has expired.

Mr. EWING. Mr. Chairman, 30 seconds? The witness took almost all my time——

Chairman SENSENBRENNER. Well——

Mr. EWING [continuing]. In some lecture. But I just would like to make the record clear here that all of us are for improving the environment. I've talked with people who came back from Japan and the negotiations, and I think there were some problems in those negotiations and how much we gave away. We have something to negotiate, and we should be very firm on that. We should work for the best situation for the whole world, and not expect it all to happen here in the developed nations and in the United States. That's probably what you have to sell to this Congress, if you—and I'm not asking for a response. My time is up, and I've been told that I'm done.

Mr. EIZENSTAT. I want to say that I agree wholeheartedly with your last statement; that is to say, that we have a lot of work to do, Congressman Ewing, in terms of getting other countries involved. We got the developed countries. We've gotten what we want there. We do not have the degree of participation by developing countries we need for a complete product. This is a first step, and a first step only.

Chairman SENSENBRENNER. Now I did promise Secretary Eizenstat he'd be out by 2 p.m. So I'd like Mr. Ehlers and Mr. English to argue amongst themselves on who has the last 5 minutes to ask questions. The gentleman is recognized for 2 exact minutes.

IMPORTANCE OF DEALING WITH CLIMATE ISSUES FACTUALLY

Mr. EHLERS. Thank you. I just wanted to reinforce the comment made earlier. I'm concerned about your statements that all of these effects are measurable. Not all of them are measurable. Also, your reference to scientists agree, not all scientists agree. There is considerable uncertainty as you get into some of these areas, and, as Mr. Ewing said, you're representing the Administration well. And I'm aware of the position, particularly the Vice President's, and I admire his concern for the environment, but I think it's very important to try to deal with these issues factually with as much of a knowledge base as we have, and where we don't have it, let's get it, and make the most intelligent and best decision we can.

I'd caution you about talking about all these being measurable effects. They aren't. With global warming, there's still considerable agreement on that. I don't think there's disagreement on global climate effects that we will have.

Thank you, Mr. Chairman.

Chairman SENSENBRENNER. The gentleman from Pennsylvania is recognized for precisely 3 minutes.

Mr. ENGLISH. And I will keep this brief. I have really two questions, so I'd ask you to be compressed in your response, as you have been.

ADMINISTRATION'S INTENT WITH RESPECT TO IMPLEMENTATION OF THE PROTOCOL PRIOR TO SENATE RATIFICATION AND IMPACT OF DELAYS ON MEETING EMISSIONS TARGETS

Mr. ENGLISH. First of all, following up on the Chairman's comments, if we do not have binding treaty obligations until the Senate signs on and approves the treaty, one, will the Administration promise not to implement the treaty by regulation until after the Senate ratifies; and the second part, doesn't any delay in implementation make the job of reducing CO_2 even tougher?

Mr. EIZENSTAT. Very quickly, obviously, we are trying to get through Congress a jump-start through the R&D efforts, but in terms of binding obligations, we do not intend to in any way, shape, or form, through the back door, the front door, the side door, or any other efforts, to bind this country, or any other sectors of this country, until the Senate has acted in a constitutional manner.

Mr. ENGLISH. And you're not concerned that the delay makes CO_2——

Mr. EIZENSTAT. Absolutely. That's one of the reasons we feel a sense of urgency about it.

ROLE OF NUCLEAR ENERGY

Mr. ENGLISH. Final question: One technology that has not been proposed as part of your strategy for reducing emissions has to do with nuclear. Do you believe that we need to expand the use of nuclear energy? And, two, do we need to encourage and facilitate other countries like China utilizing nuclear perhaps through technology transfer down the road?

Mr. EIZENSTAT. Let me answer that in two ways. First of all, from your State, which is one of the great coal-producing States, one of the parts of the President's initiative is a clean coal technology effort, and this is, again, I don't think we should write coal off in our energy future. We can produce cleaner coal.

Second, with respect to nuclear, I'm going to give you my personal view. I can't speak for the Administration. I don't make energy policy. My personal view is nuclear power has to have an important role in the future, an increasing role in the future. If want, for example, China to move away from heavy coal without modern technology, and China will be—they're already the second biggest emitter; they'll be the biggest emitter—then nuclear power is key. The President certified just a few months ago, at the time of the Summit, that they could now receive nuclear energy, and this would be a big job creator. Westinghouse is in your State, for example, and nuclear power plants in places like China I think have to be part of this solution for developing countries.

Mr. ENGLISH. Thank you very much. Thank you, Mr. Chairman.

Chairman SENSENBRENNER. This concludes the hearing on time.

Mr. EIZENSTAT. Thank you, Mr. Chairman. This is the only thing about Kyoto that's ever been on time, I think, and I appreciate it.

Chairman SENSENBRENNER. I would like to thank you for coming up, for a very lively discussion. I'm sure it will not be the last one.

The Committee is adjourned.

[Whereupon, at 2:00 p.m., the hearing was adjourned.]

APPENDIX 1: Additional Statement Submitted for the Record

People for the USA

March 4, 1998

The Honorable F.J. Sensenbrenner
House Committee on Science
389 Ford House Office Building (Annex 2)
Washington, DC 20515

Congressman Sensenbrenner:

Please accept the following comments as testimony for the record for the March 5, 1998 House Committee on Science oversight hearing on the Kyoto Protocol.

Thank you for your assistance.

Jeffrey P. Harris
Executive Director
People for the USA

P.O. Box 4345, Pueblo, CO 81003 • PH:(719)543-8421 • FAX:(719)543-9473 • e-mail:pfw@usa.net

People for the USA

March 4, 1998

The Honorable F.J. Sensenbrenner
House Committee on Science
389 Ford House Office Building (Annex 2)
Washington, DC 20515

Mr. Chairman,

I am submitting written testimony for your March 5, 1998 Committee oversight hearing on the Kyoto Protocol on behalf of the more than 25,000 members of People for the USA. Our members support common sense and economic balance in the environmental debate and advocate sound land management and natural resource production.

We do not believe that the Senate should ratify the Protocol, nor should President Clinton sign it. We also hope that members of your committee and others in Congress will help ensure that the Protocol does not become a reality through executive fiat or backdoor implementation.

Scientists have yet to agree on whether global warming exists and if so, what causes it. Central to the problem is the sheer complexity of nature and the relative feebleness of our tools to assess it. In addition to CO_2, many other powerful forces -- from clouds to volcanic eruptions to tree growth -- determine the Earth's climate.

Put into proper perspective, water vapor accounts for 99% of natural global warming. The remaining 1% stems from CO_2 and other gases, which are themselves mainly products of nature, not man. CO_2 accounts for only 1% of the greenhouse effect, and human-made CO_2 accounts for only 4% of that 1%. This works out to the human impact on the greenhouse effect being roughly 0.04% of a total annual effect. The other 99.96% is caused by nature.

Economically rational policy options have little support. And until the most cost-effective options to reduce greenhouse gases are identified, policy makers are often operating in the dark.

One of the few certainties about global warming is that the costs of severely curbing emissions of greenhouse gases now would be huge. The world relies on carbon-based fuels for most of its energy needs. An enforced switch to non-polluting alternatives would savagely cut people's living standards.

The costs to the U.S. in terms of jobs, income and economic growth would be incurred without any demonstrable benefit, other than to the developing countries excluded by the Kyoto proposal.

We encourage industry/government voluntary partnerships to continue and believe that industry is committed to actions that make economic and scientific sense.

We appreciate any attempts by Congressional leaders to recognize the scientific uncertainties surrounding the popular vision of climate change, and ask members of Congress and the Clinton Administration to stop plans for draconian carbon dioxide reduction and short-term phaseouts of fossil fuels.

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The costs of the Kyoto Protocol are high -- too high for the average American, especially those in rural areas, who won't have the means to afford higher fuel bills or new, fuel-efficient or alternative energy vehicles for everyday transportation. This is a long-term issue, giving us much more time for more telling science and deciding what we really need to do. There's much more time to do research on how we can reduce emissions without paying a price that American families simply cannot afford.

Please do not allow the fears promulgated by environmental extremists and others to outrun scientific knowledge on the subject. With a firmer scientific grip on the influences of climate, we may better afford to make a decision in the future. As future consumers reach voluntarily for the results of proven research, the cost of altering the world's economic structure should be much lower.

Form **990**

Department of the Treasury
Internal Revenue Service

Return of Organization Exempt From Income Tax

Under section 501(c) of the Internal Revenue Code (except black lung benefit trust or private foundation) or section 4947(a)(1) nonexempt charitable trust

Note: *The organization may have to use a copy of this return to satisfy state reporting requirements.*

OMB No 1545-0047

1996

This Form is Open to Public Inspection

A For the 1996 calendar year, OR tax year period beginning July 1, 1996, and ending June 30, 19 97

B Check if:
☐ Change of address
☐ Initial return
☐ Final return
☐ Amended return (required also for State reporting)

Pler use labe prin typ Se Spe Instu tions. IRS

BS 84-1090213 9706 29 06 CO 67173 IA
NATIONAL COALITION FOR PUBLIC LANDS
AND NATURAL RESOURCESC
301 N MAIN 305
PUEBLO CO 81003

D Employer identification number
84 : 1090213

E State registration number

F Check ▶ ☐ if exemption application is pending

G Type of organization—▶ ☒ Exempt under section 501(c)(6) ◀ (insert number) OR ▶ ☐ section 4947(a)(1) nonexempt charitable trust

Note: *Section 501(c)(3) exempt organizations and 4947(a)(1) nonexempt charitable trusts MUST attach a completed Schedule A (Form 990).*

H(a) Is this a group return filed for affiliates? ☐ Yes ☒ No

(b) If "Yes," enter the number of affiliates for which this return is filed ▶

(c) Is this a separate return filed by an organization covered by a group ruling? ☐ Yes ☒ No

I If either box in H is checked "Yes," enter four-digit group exemption number (GEN) ▶

J Accounting method: ☐ Cash ☒ Accrual ☐ Other (specify) ▶

K Check here ▶ ☐ if the organization's gross receipts are normally not more than $25,000. The organization need not file a return with the IRS; but if it received a Form 990 Package in the mail, it should file a return without financial data. Some states require a complete return.

Note: *Form 990-EZ may be used by organizations with gross receipts less than $100,000 and total assets less than $250,000 at end of year.*

Part I Revenue, Expenses, and Changes in Net Assets or Fund Balances (See Specific Instructions on page 9.)

Revenue	1	Contributions, gifts, grants, and similar amounts received:				
	a	Direct public support	1a	430,445		
	b	Indirect public support	1b	617		
	c	Government contributions (grants)	1c			
	d	**Total** (add lines 1a through 1c) (attach schedule of contributors) (cash $ 406,937 noncash $ 24,125) See Schedule I			1d	431,062
	2	Program service revenue including government fees and contracts (from Part VII, line 93)			2	
	3	Membership dues and assessments			3	398,905
	4	Interest on savings and temporary cash investments			4	3,283
	5	Dividends and interest from securities			5	9
	6a	Gross rents	6a			
	b	Less: rental expenses	6b			
	c	Net rental income or (loss) (subtract line 6b from line 6a)			6c	
	7	Other investment income (describe ▶)			7	
	8a	Gross amount from sale of assets other than inventory	(A) Securities 1,013	8a	(B) Other	
	b	Less: cost or other basis and sales expenses	942	8b		
	c	Gain or (loss) (attach schedule) Sch II	71	8c		
	d	Net gain or (loss) (combine line 8c, columns (A) and (B))			8d	71
	9	Special events and activities (attach schedule)				
	a	Gross revenue (not including $ of contributions reported on line 1a)	9a			
	b	Less: direct expenses other than fundraising expenses	9b			
	c	Net income or (loss) from special events (subtract line 9b from line 9a)			9c	
	10a	Gross sales of inventory, less returns and allowances	10a			
	b	Less: cost of goods sold	10b			
	c	Gross profit or (loss) from sales of inventory (attach schedule) (subtract line 10b from line 10a)			10c	
	11	Other revenue (from Part VII, line 103)			11	558
	12	**Total revenue** (add lines 1d, 2, 3, 4, 5, 6c, 7, 8d, 9c, 10c, and 11)			12	833,888
Expenses	13	Program services (from line 44, column (B))			13	
	14	Management and general (from line 44, column (C))			14	
	15	Fundraising (from line 44, column (D))			15	
	16	Payments to affiliates (attach schedule)			16	
	17	**Total expenses** (add lines 16 and 44, column (A))			17	779,000
Net Assets	18	Excess or (deficit) for the year (subtract line 17 from line 12)			18	54,888
	19	Net assets or fund balances at beginning of year (from line 73, column (A))			19	(7,100)
	20	Other changes in net assets or fund balances (attach explanation) Explanation A			20	2,469
	21	Net assets or fund balances at end of year (combine lines 18, 19, and 20)			21	50,257

For Paperwork Reduction Act Notice, see page 1 of the separate instructions. Cat. No 11282Y Form **990** (1996)

Part II **Statement of Functional Expenses** All organizations must complete column (A). Columns (B), (C), and (D) are required for section 501(c)(3) and (4) organizations and section 4947(a)(1) nonexempt charitable trusts but optional for others. (See Specific Instructions on page 13.)

Do not include amounts reported on line 6b, 8b, 9b, 10b, or 16 of Part I.		(A) Total	(B) Program services	(C) Management and general	(D) Fundraising
22 Grants and allocations (attach schedule) (cash $ ______ noncash $ ______)	22				
23 Specific assistance to individuals (attach schedule)	23				
24 Benefits paid to or for members (attach schedule)	24				
25 Compensation of officers, directors, etc.	25	84,308			
26 Other salaries and wages	26	334,385			
27 Pension plan contributions	27				
28 Other employee benefits	28	19,918			
29 Payroll taxes	29	38,396			
30 Professional fundraising fees	30				
31 Accounting fees	31	2,430			
32 Legal fees	32	300			
33 Supplies	33	17,245			
34 Telephone	34	27,112			
35 Postage and shipping	35	33,386			
36 Occupancy	36	21,600			
37 Equipment rental and maintenance	37	2,831			
38 Printing and publications	38	27,876			
39 Travel	39	76,981			
40 Conferences, conventions, and meetings	40	51,037			
41 Interest	41				
42 Depreciation, depletion, etc. (attach schedule)	42	6,117			
43 Other expenses (itemize): a Office Exp.	43a	19,171			
b Insurance	43b	9,738			
c Contract Services	43c	1,500			
d Miscellaneous	43d	4,669			
e	43e				
44 Total functional expenses (add lines 22 through 43) *Organizations completing columns (B)-(D), carry these totals to lines 13-15*	44	779,000			

Reporting of Joint Costs.—Did you report in column (B) (Program services) any joint costs from a combined educational campaign and fundraising solicitation? ▶ ☐ Yes ☒ No

If "Yes," enter (i) the aggregate amount of these joint costs $______; (ii) the amount allocated to Program services $______; (iii) the amount allocated to Management and general $ ______; and (iv) the amount allocated to Fundraising $ ______

Part III **Statement of Program Service Accomplishments** (See Specific Instructions on page 16.)

What is the organization's primary exempt purpose? ▶ To advocate continued multiple use and natural resource development on public and private lands through education and community organization. All organizations must describe their exempt purpose achievements. State the number of clients served, publications issued, etc. Discuss achievements that are not measurable. (Section 501(c)(3) and (4) organizations and 4947(a)(1) nonexempt charitable trusts must also enter the amount of grants and allocations to others.)	**Program Service Expenses** (Required for 501(c)(3) and (4) orgs., and 4947(a)(1) trusts, but optional for others.)
a Continued to organize chapters, distribute information on public lands and natural resource issues through our People for the West newspaper, fact sheets, alerts, press releases and various communications with chapters. (Grants and allocations $)	
b Published and distributed the People for the West newspaper giving the latest information on public lands and natural resource issues. Included several resource directories. (Grants and allocations $)	
c Conducted various chapter workshops to educate members on the political process and how to get involved, and educate them on public lands and natural resource issues. (Grants and allocations $)	
d Co-sponsored two conferences and participated in a national conference dealing with similar issues. (Grants and allocations $)	
e Other program services (attach schedule) (Grants and allocations $)	
f **Total of Program Service Expenses** (should equal line 44, column (B), Program services) ▶	

RECEIVED OCT 2 8 1997

Form **2758**
(Rev May 1995)
Department of the Treasury
Internal Revenue Service

Application for Extension of Time To File Certain Excise, Income, Information, and Other Returns

► File a separate application for each return.

OMB No. 1545-014

Please type or print. File the **original and one copy** by the due date for filing your return. See instructions on back.

Name: National Coalition for Public Lands & Natural Resources

Employer identification number: 84 : 1090213

Number, street, and room or suite no (or P.O box no if mail is not delivered to street address): 301 N. Main Street, Suite 306

City, town or post office, state, and ZIP code. For a foreign address, see instructions: Pueblo, CO 81003

Note: *Corporate income tax return filers must use* ***Form 7004*** *to request an extension of time to file. Partnerships, REMICs, and trusts must use* ***Form 8736*** *to request an extension of time to file Form 1065, 1066, or 1041.*

1 I request an extension of time until Feb. 15, 19 98, to file (check only one):

☐ Form 706-GS(D)
☐ Form 706-GS(T)
☒ Form 990 or 990-EZ
☐ Form 990-BL
☐ Form 990-PF
☐ Form 990-T (401(a) or 408(a) trust)
☐ Form 990-T (trust other than above)
☐ Form 1041 (estate) (see instructions)
☐ Form 1041-A
☐ Form 1042
☐ Form 1120-ND (4951 taxes)
☐ Form 3520-A
☐ Form 4720
☐ Form 5227
☐ Form 6069
☐ Form 8612
☐ Form 8613
☐ Form 8725
☐ Form 8804
☐ Form 8831

If the organization does not have an office or place of business in the United States, check this box. . . . ► ☐

2a For calendar year 19 ..... , or other tax year beginning July 1, 1996 and ending June 30, 1997

b If this tax year is for less than 12 months, check reason: ☐ Initial return ☐ Final return ☐ Change in accounting period

3 Has an extension of time to file been previously granted for this tax year? . . . . ☐ Yes ☒ No

4 State in detail why you need the extension Information necessary to file a complete and accurate tax return will not be available by the due date.

5a If this form is for Form 706-GS(D), 706-GS(T), 990-BL, 990-PF, 990-T, 1041 (estate), 1042, 1120-ND, 4720 6069, 8612, 8613, 8725, 8804, or 8831, enter the tentative tax, less any nonrefundable credits. See instructions. $ None

b If this form is for Form 990-PF, 990-T, 1041 (estate), 1042, or 8804, enter any refundable credits and estimated tax payments made. Include any prior year overpayment allowed as a credit . . . . . . $

c **Balance due.** Subtract line 5b from line 5a. Include your payment with this form, or deposit with FTD coupon if required. See instructions . . . . $ None

Signature and Verification

Under penalties of perjury, I declare that I have examined this form, including accompanying schedules and statements, and to the best of my knowledge and belief, it is true, correct, and complete, and that I am authorized to prepare this form.

Signature ► Title ► Executive Director Date ► 9/23/97

FILE ORIGINAL AND ONE COPY. The IRS will show below whether or not your application is approved and will return the copy.

Notice to Applicant—To Be Completed by the IRS

☑ We **HAVE** approved your application. Please attach this form to your return.

☐ We **HAVE NOT** approved your application. However, we have granted a 10-day grace period from the later of the date shown below or the due date of your return (including any prior extensions). This grace period is considered to be a valid extension of time for elections otherwise required to be made on a timely return. Please attach this form to your return.

☐ We **HAVE NOT** approved your application. After considering the reasons stated in item 4, we cannot grant your request for an extension of time to file. We are not granting the 10-day grace period.

☐ We cannot consider your application because it was filed after the due date of the return for which an extension was requested.

☐ Other: EXTENSION APPROVED

Director By: Date

FEB 1 7 1998

If you want a copy of this form to be returned to an address other than that shown above, please enter the address to which the copy should be sent.

Please Type or Print

Name: DEBORAH S. DECKER

Number, street, and room or suite no. (or P.O. box no. if mail is not delivered to street address) OGDEN SERVICE CENTER

City, town or post office, state, and ZIP code. For a foreign address, see instructions.

Part IV Balance Sheets (See Specific Instructions on page 16.)

		Note: *Where required, attached schedules and amounts within the description column should be for end-of-year amounts only.*			(A) Beginning of year		(B) End of year
Assets	45	Cash—non-interest-bearing			36,691	45	60
	46	Savings and temporary cash investments			54,957	46	119,630
	47a	Accounts receivable	47a				
	b	Less: allowance for doubtful accounts	47b			47c	
	48a	Pledges receivable	48a				
	b	Less: allowance for doubtful accounts	48b			48c	9,268
	49	Grants receivable				49	
	50	Receivables from officers, directors, trustees, and key employees (attach schedule)				50	
	51a	Other notes and loans receivable (attach schedule)	51a				
	b	Less: allowance for doubtful accounts	51b			51c	
	52	Inventories for sale or use				52	
	53	Prepaid expenses and deferred charges			14,516	53	11,701
	54	Investments—securities (attach schedule) Schedule III			899	54	26,594
	55a	Investments—land, buildings, and equipment: basis	55a				
	b	Less: accumulated depreciation (attach schedule)	55b			55c	
	56	Investments—other (attach schedule)				56	
	57a	Land, buildings, and equipment: basis	57a	56,679			
	b	Less: accumulated depreciation (attach schedule). Schedule IV	57b	(41,070)	15,104	57c	15,609
	58	Other assets (describe ▶ Organizational Costs/Other Receivables)			1,175	58	3,225
	59	**Total assets** (add lines 45 through 58) (must equal line 74)			123,342	59	186,087
Liabilities	60	Accounts payable and accrued expenses			25,442	60	30,830
	61	Grants payable				61	
	62	Deferred revenue				62	
	63	Loans from officers, directors, trustees, and key employees (attach schedule). Schedule V			105,000	63	105,000
	64a	Tax-exempt bond liabilities (attach schedule)				64a	
	b	Mortgages and other notes payable (attach schedule)				64b	
	65	Other liabilities (describe ▶)				65	
	66	**Total liabilities** (add lines 60 through 65)			130,442	66	135,830
Net Assets or Fund Balances		**Organizations that follow SFAS 117, check here** ▶ ☐ and complete lines 67 through 69 and lines 73 and 74.					
	67	Unrestricted			(7,100)	67	50,257
	68	Temporarily restricted				68	
	69	Permanently restricted				69	
		Organizations that do not follow SFAS 117, check here ▶ ☐ and complete lines 70 through 74.					
	70	Capital stock, trust principal, or current funds				70	
	71	Paid-in or capital surplus, or land, building, and equipment fund				71	
	72	Retained earnings, endowment, accumulated income, or other funds				72	
	73	**Total net assets or fund balances** (add lines 67 through 69 OR lines 70 through 72; column (A) must equal line 19 and column (B) must equal line 21)			(7,100)	73	50,257
	74	**Total liabilities and net assets / fund balances** (add lines 66 and 73)			123,342	74	186,087

Part IV-A Reconciliation of Revenue per Audited Financial Statements with Revenue per Return (See Specific Instructions, page 18.)

a	Total revenue, gains, and other support per audited financial statements . . ▶	a	N/A
b	Amounts included on line a but not on line 12, Form 990:		
(1)	Net unrealized gains on investments . . $		
(2)	Donated services and use of facilities $		
(3)	Recoveries of prior year grants . . . $		
(4)	Other (specify): .... $		
	Add amounts on lines (1) through (4) ▶	b	
c	Line a minus line b. . . . . . ▶	c	
d	Amounts included on line 12, Form 990 but not on line a:		
(1)	Investment expenses not included on line 6b, Form 990 . . . $		
(2)	Other (specify): .... $		
	Add amounts on lines (1) and (2) ▶	d	
e	Total revenue per line 12, Form 990 (line c plus line d) . . . . . . ▶	e	

Part IV-B Reconciliation of Expenses per Audited Financial Statements with Expenses per Return

a	Total expenses and losses per audited financial statements . . ▶	a	N/A
b	Amounts included on line a but not on line 17, Form 990:		
(1)	Donated services and use of facilities $		
(2)	Prior year adjustments reported on line 20, Form 990 . . . . $		
(3)	Losses reported on line 20, Form 990 . $		
(4)	Other (specify): .... $		
	Add amounts on lines (1) through (4) ▶	b	
c	Line a minus line b . . . . . ▶	c	
d	Amounts included on line 17, Form 990 but not on line a:		
(1)	Investment expenses not included on line 6b, Form 990. . . $		
(2)	Other (specify): .... $		
	Add amounts on lines (1) and (2) ▶	d	
e	Total expenses per line 17, Form 990 (line c plus line d) . . . . . ▶	e	

Part V List of Officers, Directors, Trustees, and Key Employees (List each one even if not compensated; see Specific Instructions on page 18.)

(A) Name and address	(B) Title and average hours per week devoted to position	(C) Compensation (If not paid, enter -0-.)	(D) Contributions to employee benefit plans & deferred compensation	(E) Expense account and other allowances
See Schedule VI				

75 Did any officer, director, trustee, or key employee receive aggregate compensation of more than $100,000 from your organization and all related organizations, of which more than $10,000 was provided by the related organizations? ▶ ☐ Yes ☐ No

If "Yes," attach schedule—see Specific Instructions on page 18.

Part VI Other Information (See Specific Instructions on page 19.)

				Yes	No
76	Did the organization engage in any activity not previously reported to the IRS? If "Yes," attach a detailed description of each activity .	76			X
77	Were any changes made in the organizing or governing documents but not reported to the IRS? . . . If "Yes," attach a conformed copy of the changes.	77			X
78a	Did the organization have unrelated business gross income of $1,000 or more during the year covered by this return?.	78a			X
b	If "Yes," has it filed a tax return on **Form 990-T** for this year?	78b		N/A	
79	Was there a liquidation, dissolution, termination, or substantial contraction during the year? If "Yes," attach a statement	79			X
80a	Is the organization related (other than by association with a statewide or nationwide organization) through common membership, governing bodies, trustees, officers, etc., to any other exempt or nonexempt organization? . . .	80a			X
b	If "Yes," enter the name of the organization ▶ .... and check whether it is ☐ exempt **OR** ☐ nonexempt				
81a	Enter the amount of political expenditures, direct or indirect, as described in the instructions for line 81.	81a	0		
b	Did the organization file **Form 1120-POL** for this year?.	81b			X
82a	Did the organization receive donated services or the use of materials, equipment, or facilities at no charge or at substantially less than fair rental value?	82a			X
b	If "Yes," you may indicate the value of these items here. Do not include this amount as revenue in Part I or as an expense in Part II. (See instructions for reporting in Part III.).	82b			
83a	Did the organization comply with the public inspection requirements for returns and exemption applications?	83a		X	
b	Did the organization comply with the disclosure requirements relating to quid pro quo contributions? . .	83b		X	
84a	Did the organization solicit any contributions or gifts that were not tax deductible?	84a		X	
b	If "Yes," did the organization include with every solicitation an express statement that such contributions or gifts were not tax deductible?	84b		X	
85	*501(c)(4), (5), or (6) organizations.*—a Were substantially all dues nondeductible by members?	85a			X
b	Did the organization make only in-house lobbying expenditures of $2,000 or less? If "Yes" was answered to either 85a or 85b, **do not** complete 85c through 85h below unless the organization received a waiver for proxy tax owed for the prior year.	85b			X
c	Dues, assessments, and similar amounts from members	85c	398,905		
d	Section 162(e) lobbying and political expenditures	85d	29,836		
e	Aggregate nondeductible amount of section 6033(e)(1)(A) dues notices	85e	47,869		
f	Taxable amount of lobbying and political expenditures (line 85d less 85e)	85f	(18,033)		
g	Does the organization elect to pay the section 6033(e) tax on the amount in 85f?.	85g		N/A	
h	If section 6033(e)(1)(A) dues notices were sent, does the organization agree to add the amount in 85f to its reasonable estimate of dues allocable to nondeductible lobbying and political expenditures for the following tax year?. . .	85h		N/A	
86	*501(c)(7) organizations.*—Enter: a Initiation fees and capital contributions included on line 12	86a			
b	Gross receipts, included on line 12, for public use of club facilities.	86b			
87	*501(c)(12) organizations.*—Enter: a Gross income from members or shareholders	87a			
b	Gross income from other sources. (Do not net amounts due or paid to other sources against amounts due or received from them.)	87b			
88	At any time during the year, did the organization own a 50% or greater interest in a taxable corporation or partnership? If "Yes," complete Part IX	88			X
89a	*501(c)(3) organizations.*—Enter: Amount of tax paid during the year under: section 4911 ▶ ______ ; section 4912 ▶ ______ ; section 4955 ▶ ______				
b	*501(c)(3) and 501(c)(4) organizations.*—Did the organization engage in any section 4958 excess benefit transaction during the year? If "Yes," attach a statement explaining each transaction	89b		N/A	
c	Enter: Amount of tax paid by the organization managers or disqualified persons during the year under section 4958 ▶		N/A		
d	Enter: Amount of tax in **89c**, above, reimbursed by the organization ▶		N/A		

90 List the states with which a copy of this return is filed ▶

91 The books are in care of ▶ National Coalition for Public Lands Telephone no. ▶ (719) 543-8421
Located at ▶ 301 N. Main Street, Suite 306, Pueblo, CO ZIP + 4 ▶ 81003

92 *Section 4947(a)(1) nonexempt charitable trusts filing Form 990 in lieu of **Form 1041***—Check here ▶ ☐
and enter the amount of tax-exempt interest received or accrued during the tax year ▶ 92

Part VII Analysis of Income-Producing Activities (See Specific Instructions on page 22.)

Enter gross amounts unless otherwise indicated.	Unrelated business income		Excluded by section 512, 513, or 514		(E) Related or exempt function income
	(A) Business code	(B) Amount	(C) Exclusion code	(D) Amount	
93 Program service revenue:					
a					
b					
c					
d					
e					
f					
g Fees and contracts from government agencies					
94 Membership dues and assessments					398,905
95 Interest on savings and temporary cash investments			14	3,283	
96 Dividends and interest from securities			14	9	
97 Net rental income or (loss) from real estate:	▨	▨	▨	▨	▨
a debt-financed property					
b not debt-financed property					
98 Net rental income or (loss) from personal property					
99 Other investment income					
100 Gain or (loss) from sales of assets other than inventory			18	71	
101 Net income or (loss) from special events					
102 Gross profit or (loss) from sales of inventory					
103 Other revenue: a Other Revenue			01	558	
b					
c					
d					
e					
104 Subtotal (add columns (B), (D), and (E))	▨		▨	3,921	398,905

105 **Total** (add line 104, columns (B), (D), and (E)) ▶ 402,826

Note: *(Line 105 plus line 1d, Part I, should equal the amount on line 12, Part I.)*

Part VIII Relationship of Activities to the Accomplishment of Exempt Purposes (See Specific Instructions on page 23.)

Line No. ▼	Explain how each activity for which income is reported in column (E) of Part VII contributed importantly to the accomplishment of the organization's exempt purposes (other than by providing funds for such purposes).
94	The National Coalition for Public Lands and Natural Resources (NCPLNR) was incorporated on July 1, 1988 as a non-partisan, non-profit coalition of public lands supporters. NCPLNR's mission is to advocated continued multiple use and natural resources development on public and private lands through education and community organization. During FY 1990-1991, NCPLNR began publishing the "People for the West!" newspaper to foster awareness of federal, state and local issues specific to land use and natural resource development. The membership dues and expenditures relating to these activities have been treated as support for our program services.

Part IX Information Regarding Taxable Subsidiaries (Complete this Part if the "Yes" box on line 88 is checked.)

Name, address, and employer identification number of corporation or partnership	Percentage of ownership interest	Nature of business activities	Total income	End-of-year assets
	%			
	%			
	%			
	%			

Please Sign Here

Under penalties of perjury, I declare that I have examined this return, including accompanying schedules and statements, and to the best of my knowledge and belief, it is true, correct, and complete. Declaration of preparer (other than officer) is based on all information of which preparer has any knowledge (See General Instructions on page 8.)

▶ Signature of officer | 2/11/98 Date | ▶ Jeffrey P. Harris, Executive Directo Type or print name and title.

Paid Preparer's Use Only

Preparer's signature ▶	Date	Check if self-employed ▶ ☐	Preparer's SSN
Firm's name (or yours if self-employed) and address ▶		EIN ▶ ZIP + 4 ▶	

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES
Investments - securities -- Line 54
Tax ID #84-1090213

1996 Form 990
Schedule III
Page 1 of 1

	Beginning of year	End of year
Common Stock at market value	$ 899	$ 26,594

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES
Schedule of Gain -- Line 8d
Tax ID #84-1090213

1996 Form 990
Schedule II
Page 1 of 1

Common Stock		
Gross Sales Price	$	1,013
Less: Basis		(899)
Sales Expense		(43)
	$	71

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES
Land, Buildings and Equipment -- Line 57
Tax ID #84-1090213

1996 Form 990
Schedule IV
Page 1 of 1

	Cost	Accum. Depr.	Book Value
COMPUTERS & EQUIP.	$ 34,121	$ 24,309	$ 9,812
OFFICE FURNITURE	12,860	8,358	4,502
PHONES & SOFTWARE	9,698	8,403	1,295
Totals	$ 56,679	$ 41,070	$ 15,609

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES
Loans -- Line 63
Tax ID #84-1090213

1996 Form 990
Schedule V
Page 1 of 1

Name of Lender	Balance Due
ASARCO, Inc.	$ 50,000

1. Original Amount -- $50,000
2. Date of loan -- 9/29/94
3. Maturity date -- N/A
4. Repayment terms -- $50,000 due on demand
5. Interest rate -- Non-interest bearing
6. Security provided by borrower -- Unsecured
7. Purpose of the loan -- Temporary Cash Advance
8. Description and value of consideration -- Cash - $50,000

Name of Lender	Balance Due
Hecla Mining Company	$ 30,000

1. Original Amount -- $30,000
2. Date of loan -- 9/8/93
3. Maturity date -- N/A
4. Repayment terms -- $30,000 due on demand
5. Interest rate -- Non-interest bearing
6. Security provided by borrower -- Unsecured
7. Purpose of the loan -- Temporary Cash Advance
8. Description and value of consideration -- Cash - $30,000

Name of Lender	Balance Due
Placer Dome U.S., Inc.	$ 25,000

1. Original Amount -- $85,000
2. Date of loan -- 10/13/93
3. Maturity date -- N/A
4. Repayment terms -- $25,000 due on demand
5. Interest rate -- Non-interest bearing
6. Security provided by borrower -- Unsecured
7. Purpose of the loan -- Temporary Cash Advance
8. Description and value of consideration -- Cash - $25,000

Total Loans $ 105,000

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES

List of Officers, Directors & Key Employees
Tax ID #84-1090213

1996 Form 990
Schedule VI
Page 1 of 3

(A) Name and address	(B) Title & Hours	(C) Compensation	Contributions to (D) Employee Ben. Plans	(E) Expenses
1. Elizabeth Arnold P.O Box 954 Beatty, NV 89003-0954	Chairman of the Board Minimal	Zero	Zero	Zero
2 Bob Quick ASARCO, Inc P.O. Box 5747 Tucson, AZ 85703	President Minimal	Zero	Zero	Zero
3. Walter Nowotny Doe Run Company 1801 Park 270 Drive St. Louis, MO 63146	Vice President Minimal	Zero	Zero	Zero
4. Alex Bissett Consolidated Nevada Goldfields 1801 Broadway, Suite 1620 Denver, CO 80202	Secretary/Treasurer Minimal	Zero	Zero	Zero
5. Ken Bennett Phelps Dodge Mining Co 2600 N. Central Avenue Phoenix, AZ 85004-3014	Director Minimal	Zero	Zero	Zero
6. Jerome Bensing Echo Bay Mines 6400 S. Fiddlers Green Cir., Ste. 1000 Englewood, CO 80111-4957	Director Minimal	Zero	Zero	Zero
7. Ron Clayton Rosebud Mining Company P O. Box 2610 Winnemucca, NV 89446	Director Minimal	Zero	Zero	Zero
8 Tim Dyhr BHP Copper 7400 N. Oracle Road, Suite 200 Tucson, AZ 85704	Director Minimal	Zero	Zero	Zero
9. Martin Garber, Jr. Phillips Petroleum 16th Floor, Phillips Building Bartelsville, OK 74004	Director Minimal	Zero	Zero	Zero
10. Rob Geibel Harnischfeger Corp. 1811 S. Alma School Road, Suite 215 Mesa, AZ 85210	Director Minimal	Zero	Zero	Zero
11. Dale Hackbart Bridgestone/Firestone 6951 Wapiti Court Boulder, CO 80301	Director Minimal	Zero	Zero	Zero
12. Bob Irelan Conoco, Inc. 10 Desta Drive, Suite 100W Midland, TX 79705-4500	Director Minimal	Zero	Zero	Zero

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES

List of Officers, Directors & Key Employees
Tax ID #84-1090213

1996 Form 990
Schedule VI
Page 2 of 3

(A) Name and address	(B) Title & Hours	(C) Compensation	Contributions to (D) Employee Ben. Plans	(E) Expenses
13 Met Johnson Western States Coalition P.O. Box 560 New Harmony, UT 84757	Director Minimal	Zero	Zero	Zero
14. George Marich Chevron U.S.A., Inc. P.O Box 7753 San Francisco, CA 94120	Director Minimal	Zero	Zero	Zero
15. David Parker Placer Dome U.S., Inc. 240 South Rock Boulevard, Suite 117 Reno, NV 89502	Director Minimal	Zero	Zero	Zero
16. Rick Phillips J.R Simplot Company 4122 Yellowstone Avenue Pocatello, ID 83202	Director Minimal	Zero	Zero	Zero
17. George Raymond Cyprus Amax Minerals Company 9100 E. Mineral Circle Englewood, CO 80112	Director Minimal	Zero	Zero	Zero
18. Robert Reveles 10904 E. Sleepy Hollow Gold Canyon, AZ 85219-6801	Director Minimal	Zero	Zero	Zero
19. Rob Ridge Svedala Industries, Inc. 6547 S. Racine Circle, Suite 1800 Englewood, CO 80112	Director Minimal	Zero	Zero	Zero
20. Terry Ross The Center for Energy & Economic Development 7853 E. Arapahoe Court, Suite 2600 Englewood, CO 80112	Director Minimal	Zero	Zero	Zero
21 Chuck Shipley Arizona Mining Association 2702 North 3rd Street, Suite 2015 Phoenix, AZ 85004	Director Minimal	Zero	Zero	Zero
22. Michael Singer Komatsu Mining Sysytems, Inc. P.O. Box 8112 Vernon Hills, IL 60061	Director Minimal	Zero	Zero	Zero
23. Gerald Veillette Cambior USA, Inc 8101 E. Prentice Avenue, Suite 800 Englewood, CO 80111	Director Minimal	Zero	Zero	Zero
24. Bruce Vincent Alliance for America P.O. Box 1320 Libby, MT 59923	Director Minimal	Zero	Zero	Zero

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES 1996 Form 990
List of Officers, Directors & Key Employees Schedule VI
Tax ID #84-1090213 Page 3 of 3

(A) Name and address	(B) Title & Hours	(C) Compensation	Contributions to (D) Employee Ben. Plans	(E) Expenses
25. Randall Weeks Davis, Graham & Stubbs 370 17th Street, Suite 4700 Denver, CO 80202	Director Minimal	Zero	Zero	Zero
26 Arthur Wiese, Jr. American Petroleum Institute 1220 L Street Northwest Washington, D.C. 20005	Director Minimal	Zero	Zero	Zero
27. Carl Barnes Reed Lumber Company Route 2, Box 120 Potosi, MO 63664	Director Minimal	Zero	Zero	Zero
28. MaryAnn Baruch P.O. Box 17 Mimbres, NM 88049	Director Minimal	Zero	Zero	Zero
29. Raymond Berry 7513 Tudor Road Colorado Springs, CO 80919	Director Minimal	Zero	Zero	Zero
30. Dennis Brabec Box 41 Big Piney, WY 83113	Director Minimal	Zero	Zero	Zero
31. Linda Deen P.O. Box 338 Kearny, AZ 85237	Director Minimal	Zero	Zero	Zero
32. Jim Lekas Box 552 Vernal, UT 84078	Director Minimal	Zero	Zero	Zero
33. Jim Wetzig 161 Acacia Avenue San Bruno, CA 94066	Director Minimal	Zero	Zero	Zero
34. Jeffrey P. Harris NCPLNR P.O. Box 4345 Pueblo, CO 81003	Executive Director 40	$84,308	$2,635	Zero

NATIONAL COALITION FOR PUBLIC LANDS AND NATURAL RESOURCES
Explanation for Change in Net Assets -- Line 20
Tax ID #84-1090213

1996 Form 990
Explanation A
Page 1 of 1

$2,469 represents the unrealized gain on investments carried at market value.

APPENDIX 2: Answers to Post-Hearing Questions Submitted by Members of the Committee on Science

COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Hearing
on

The Road from Kyoto—Part 3: State Department Overview

Thursday, March 5, 1998

Post-Hearing Questions
Submitted to

The Honorable Stuary E. Eizenstat
Under Secretary of State for Economic, Business and Agricultural Affairs
U.S. Department of State

Post-Hearing Questions Submitted by Chairman Sensenbrenner

Climate Change and Infectious Diseases

Q1. On page 2 of your prepared testimony you stated that "Diseases that thrive in warmer climates, such as dengue fever, malaria, yellow fever, encephalitis, and cholera are likely to spread due to the expansion of the range of disease carrying organisms. By 2100, there could be an additional 50-80 million cases of malaria each year."

Please provide detailed documentation of the statement that "By 2100, there could be an additional 50-80 million cases of malaria each year."

A1. Chapter 18 ("Human Population Health") of the 1995 IPCC document "Climate Change 1995 — Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses" provides a summary of what is known on the potential human health impacts of climate change. Using a complex integrated global model developed by Martens et al. (1994), the IPCC predicted that there will be an increase of an additional 50-80 million cases of malaria annually, relative to an approximate base of 500 million annual cases in 2100 without climate change. A copy of Chapter 18 is attached for your reference. *(Chapter 18 follows)*.

18

Human Population Health

ANTHONY J. McMICHAEL, AUSTRALIA/UK

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EXECUTIVE SUMMARY

The sustained health of human populations requires the continued integrity of Earth's natural systems. The disturbance, by climate change, of physical systems (e.g., weather patterns, sea-level, water supplies) and of ecosystems (e.g., agroecosystems, disease-vector habitats) would therefore pose risks to human health. The scale of the anticipated health impacts is that of whole communities or populations (i.e., it is a public health, not a personal health, issue). These health impacts would occur in various ways, via pathways of varying directness and complexity, including disturbance of natural and managed ecosystems. With some exceptions, relatively little research has yet been done that enables quantitative description of these probable health impacts.

It is anticipated that most of the impacts would be adverse. Some would occur via relatively direct pathways (e.g., deaths from heat waves and from extreme weather events); others would occur via indirect pathways (e.g., changes in the range of vector-borne diseases). Some impacts would be deferred in time and would occur on a larger scale than most other environmental health impacts with which we are familiar. If long-term climate change ensues, indirect impacts probably would predominate.

Populations with different levels of natural, technical, and social resources would differ in their vulnerability to climate-induced health impacts. Such vulnerability, due to crowding, food insecurity, local environmental degradation, and perturbed ecosystems, already exists in many communities in developing countries. Hence, because of both the geography of climate change and these variations in population vulnerability, climate change would impinge differently on different populations.

- An increased frequency or severity of heat waves would cause an increase in (predominantly cardiorespiratory) mortality and illness (High Confidence). Studies in selected urban populations in North America, North Africa, and East Asia indicate that the number of heat-related deaths would increase several-fold in response to two general circulation model (GCM)–modeled climate change scenarios for 2050. In very large cities, this would represent several thousand extra deaths annually. Although this heat-related increase in deaths would be partially offset by fewer cold-related deaths, there are insufficient data to quantify this tradeoff; further, this balance would vary by location and according to adaptive responses (Medium Confidence).
- If extreme weather events (droughts, floods, storms, etc.) were to occur more often, increases in rates of death, injury, infectious diseases, and psychological disorders would result (High Confidence).
- Net climate change-related increases in the geographic distribution (altitude and latitude) of the vector organisms of infectious diseases (e.g., malarial mosquitoes, schistosome-spreading snails) and changes in the life-cycle dynamics of both vector and infective parasites would, in aggregate, increase the potential transmission of many vector-borne diseases (High Confidence). Malaria, of which there are currently around 350 million new cases per year (including two million deaths), provides a central example. Simulations with first-generation mathematical models (based on standard climate-change scenarios and incorporating information about the basic dynamics of climatic influences on malaria transmission) predict an increase in malaria incidence in Indonesia by 2070 and—with a highly aggregated model—an increase from around 45% to around 60% in the proportion of the world population living within the *potential* malaria transmission zone by the latter half of the next century. Although this predicted increase in *potential* transmission encroaches mostly into temperate regions, actual climate-related increases in malaria incidence (estimated by one model to be of the order of 50–80 million additional cases annually, relative to an assumed global background total of 500 million by 2100) would occur primarily in tropical, subtropical, and less well protected temperate-zone populations currently at the margins of endemically infected areas. Some localized decreases may also occur (Medium Confidence).
- Increases in non-vector-borne infectious diseases such as cholera, salmonellosis, and other food- and water-related infections also could occur, particularly in tropical and subtropical regions, because of climatic impacts on water distribution, temperature, and microorganism proliferation (Medium confidence).
- The effects of climate change on agricultural, animal, and fisheries productivity, while still uncertain, could increase the prevalence of malnutrition and hunger and their long-term health impairments, especially in children. This would most probably occur regionally, with some regions likely to experience gains, and others losses, in food production (Medium Confidence).
- There would also be many health impacts of the physical, social, and demographic disruptions caused by

rising sea levels and by climate-related shortages in natural resources (especially fresh water) (Medium Confidence).

- Because fossil-fuel combustion produces both carbon dioxide and various primary air pollutants, the climate change process would be associated with increased levels of urban air pollution. Not only is air pollution itself an important health hazard, but hotter temperatures, in urban environments, would enhance both the formation of secondary pollutants (e.g., ozone) and the health impact of certain air pollutants. There would be increases in the frequency of allergic disorders and of cardiorespiratory disorders and deaths caused by various air pollutants (e.g., ozone and particulates) (High Confidence).
- A potentially important category of health impact would result from the deterioration in social and economic circumstances that might arise from adverse impacts of climate change on patterns of employment, wealth distribution, and population mobility and settlement. Conflicts might arise over dwindling environmental resources (Medium Confidence).
- Stratospheric ozone is being depleted concurrently with greenhouse gas accumulation in the troposphere. Although there are some shared and interactive atmospheric processes between disturbances of the stratosphere and troposphere, both they and their health impacts arise via quite distinct pathways. A sustained 10–15% depletion of stratospheric ozone over several decades would cause increased exposure to ultraviolet radiation and an estimated 15–20% increase in the incidence of skin cancer in fair-skinned populations (High Confidence). Lesions of the eye (e.g., cataracts) also may increase in frequency, as might vulnerability to some infectious diseases via adverse effects on immune function (Medium Confidence).

Adaptive options to minimize health impacts include improved and extended medical care services; environmental management; disaster preparedness; protective technology (housing, air conditioning, water purification, vaccination, etc.); public education directed at personal behaviors; and appropriate professional and research training. It also will be important to assess in advance any risks to health from proposed technological adaptations (e.g., exposures that could result from using certain alternative energy sources and replacement chemicals for chlorofluorocarbons; effects of pesticide use on resistance of vector organisms and their predator populations).

There is immediate need for improved and internationalized monitoring of health-risk indicators in relation to climate change. Existing global monitoring activities should encompass health-related environmental and bioindicator-species measurements and, where appropriate, direct measures of human population health status. To assist the evolution of public understanding and social policy, the health sciences must develop improved methods, including integrated predictive models, to better assess how climate change (and other global environmental changes) would influence human health.

In conclusion, the impacts of global climate change, particularly if sustained in the longer term, could include a multitude of serious—but thus far underrecognized—impacts on human health. Human population health is an outcome that integrates many other inputs, and it depends substantially on the stability and productivity of many of Earth's natural systems. Therefore, human health is likely to be predominantly adversely affected by climate change and its effects upon those systems.

18.1. Introduction

18.1.1. Climate Change and Human Population Health: The Nature of the Relationship

Global climate change over the coming decades would have various effects upon the health of human populations (WHO, 1990; Haines and Fuchs, 1991; McMichael, 1993; Last, 1993; *Lancet*, 1994). Because of the nature of the exposures involved, the scale of these climate-related changes would, in general, apply to whole populations or communities, rather than to small groups or individuals. The assessment of health impacts therefore focuses on changes in rates of death or disease in populations.

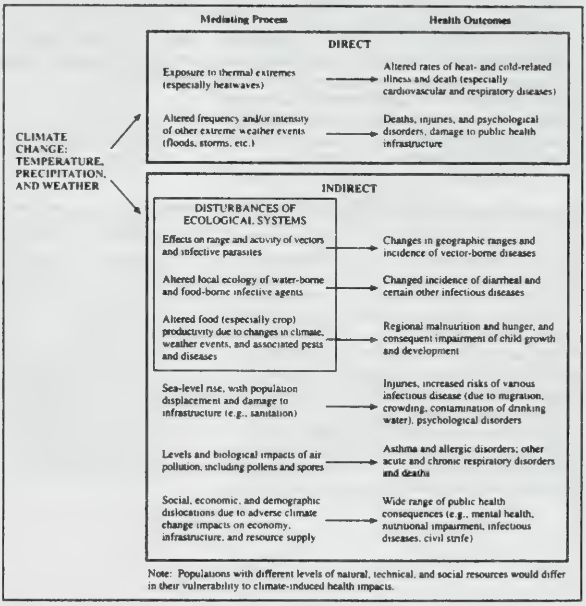
Many of the health impacts of climate change would occur via processes that are relatively unfamiliar to public-health science. They would not occur via the familiar toxicological mechanisms of localized exposure to environmental contaminants, nor via locally determined influences on the spread of infectious diseases. Instead, many of the impacts would arise via the indirect and often delayed effects of disturbances to natural systems and their associated ecological relationships. For example, changes in background climate may alter the abundance, distribution, and behavior of mosquitoes and the life cycle of the malarial parasite, such that patterns of malaria would change. Climate change also would have varied regional effects on agricultural productivity, so that some vulnerable populations may experience nutritional deprivation. There also would be some rather more readily predictable health impacts, arising, for example, from more frequent or severe heatwaves.

On a wider canvas, several of the world's ecosystems that are important in sustaining human health already have been weakened by damage, habitat loss, and species/genetic depletion. These include agricultural lands and ocean fisheries and the terrestrial ecosystems that influence the transmission of infectious diseases. Climate change may, via various processes, exacerbate those ecosystem disturbances. Because an ecosystem comprises a suite of interacting components, in which member organisms relate to the whole suite rather than to individual parts, the uncoupling of relationships by climate change could initiate a cascade of disturbances that might jeopardize human population health.

The range of potential major types of health impact is shown in Figure 18-1. For simplicity, they have been classified as "direct" and "indirect," according to whether they occur predominantly via the direct impact of a climate variable (temperature, weather variability, etc.) upon the human organism or are mediated by climate-induced changes in complex biological and geochemical systems or by climatic influences on other environmental health hazards.

18.1.2. Forecasting Health Impacts: The Challenge to Health Science

Predictions of future trends in population health are readily made in relation to actual current exposures—for example, future lung cancer rates can be predicted as a function of a population's current cigarette smoking habits (Peto *et al.*, 1994). It is unusual to make predictions on the basis of some anticipated future profile of exposure (e.g., smoking habits in the year 2020), yet this is the nature of the present exercise: Potential health impacts are being assessed in relation to future scenarios of climate change. There are inevitable, multiple uncertainties in such an approach (McMichael and Martens, 1995).


Mediating Process
Health Outcomes
DIRECT
Exposure to thermal extremes (especially heatwaves)
Altered rates of heat- and cold-related illness and death (especially cardiovascular and respiratory diseases)
Altered frequency and/or intensity of other extreme weather events (floods, storms, etc.)
Deaths, injuries, and psychological disorders, damage to public health infrastructure
CLIMATE CHANGE: TEMPERATURE, PRECIPITATION, AND WEATHER
INDIRECT
DISTURBANCES OF ECOLOGICAL SYSTEMS
Effects on range and activity of vectors and infective parasites
Changes in geographic ranges and incidence of vector-borne diseases
Altered local ecology of water-borne and food-borne infective agents
Changed incidence of diarrheal and certain other infectious diseases
Altered food (especially crop) productivity due to changes in climate, weather events, and associated pests and diseases
Regional malnutrition and hunger, and consequent impairment of child growth and development
Sea-level rise, with population displacement and damage to infrastructure (e.g., sanitation)
Injuries, increased risks of various infectious disease (due to migration, crowding, contamination of drinking water), psychological disorders
Levels and biological impacts of air pollution, including pollens and spores
Asthma and allergic disorders; other acute and chronic respiratory disorders and deaths
Social, economic, and demographic dislocations due to adverse climate change impacts on economy, infrastructure, and resource supply
Wide range of public health consequences (e.g., mental health, nutritional impairment, infectious diseases, civil strife)

Note: Populations with different levels of natural, technical, and social resources would differ in their vulnerability to climate-induced health impacts.

Figure 18-1: Ways in which climate change can affect human health.

Some aspects of climate change and its first-level impacts (on sea level, coastal ecosystems, forests, agriculture, fisheries, etc.), as projected by IPCC Working Group I, would lie outside the range of recorded human health experience. Hence, the forecasting of human health impacts must rely principally upon reference to historical analogy (where available) and reasonable extrapolation, judgment, and the use of integrated mathematical models (Niessen and Rotmans, 1993; McMichael and Martens, 1995). Most of the health impact modeling to date has been at a highly aggregated global or regional level, with no capacity to make finer-grained predictions. Ongoing developments in modeling techniques include the incorporation of complex nonlinear relationships and feedback processes, dealing with uncertainty, and richer use of local detail (Alcamo *et al.*, 1994a, 1994b).

Some health impacts can be forecast by relatively simple extrapolation from empirical epidemiological dose-response data. For example, models to predict the mortality impacts of an increase in heatwaves can be based on existing empirical data. However, predicting the health impact of climate-induced shifts in ecological relationships and habitat boundaries (e.g., malarial mosquitoes, agricultural crops) poses a more complex challenge. Equally complex is the task of predicting the various indirect health impacts of such things as sea-level rise or of civil disruption and enforced migration because of deteriorating environments and dwindling resources.

A further difficulty arises with regional predictions. Not only is the ability to predict regional differences in climate change still limited, but human populations differ greatly in their environmental circumstances, social resources, and preexisting health status. They therefore differ in their vulnerability to climate-induced stresses. Although there is generally insufficient information available to make differentiated assessments of health impacts in different populations, the balance of the assessments published to date is that, because of the geography of the impacts of climate change (particularly in relation to infectious disease transmission and food production) and of population vulnerability, many of the anticipated adverse health impacts would be greater in the world's less-developed regions. Nevertheless, in developed countries, demographic trends including population aging and increasing levels of disability, chronic illness, and coastal retirement may increase the vulnerability of populations.

Although it is tempting to compile a list of discrete health impacts, it is important that the systemic quality of the impact of climate change be understood. There would be many cross-links, including interactions of climate change with other, coexisting environmental changes. Further, the attempts of society to mitigate the health effects of climate change may actually exacerbate some of them. For example, increased use of fertilizers to compensate for a decline in local agricultural production can increase algal blooms and hence the risk of cholera or shellfish poisoning; or the relocation of populations from drought-stricken areas might introduce them to unfamiliar pathogens (or introduce their unfamiliar pathogens). Neither the scope of this chapter nor available scientific knowledge allows comprehensive consideration of these issues.

18.1.3. Sensitivities and Thresholds

Forecasting health impacts requires knowledge of, first, the sensitivity of change in population health status in response to climate change and, second, of any associated thresholds. "Sensitivity" refers to the rate of change in health outcome per unit change in climate (however defined), whereas "threshold" refers to a sudden change in slope or curvature in that dose-response graph (e.g., a certain amount of climate change may be tolerated before an impact on some particular health outcome occurs).

Although there is only limited information on the sensitivities and thresholds of human health response to climate change, some illustrative comments can be made:

- The impact of thermal stress depends on physiological tolerance thresholds being exceeded (see Section 18.2.1). For example, most studies of heat-related mortality show that increased mortality occurs only after a critical temperature has been exceeded for a certain duration. This critical temperature varies geographically, reflecting socioeconomic differences, physiological acclimatization, and cultural-technical adaptation.
- Infectious disease pathogens and insect pests are normally constrained by bioclimatic thresholds. That is, there is a range of climatic conditions with upper and lower thresholds within which a population of organisms is viable (Dobson and Carper, 1993). These thresholds account for seasonal and longer-term fluctuations in the distribution and abundance of most organisms. The uncoupling, by climate change, of previously stable ecological relationships between species would reveal other thresholds as population imbalances pass critical points.
- Changes in the distribution of organisms (e.g., mosquitoes) that spread vector-borne diseases (e.g., malaria) would occur if climate change causes their geographic range to shift. This shift would reflect the critical thresholds of temperature, precipitation, and humidity (i.e., the bioclimatograph) for vector maturation and persistence. For example, the range of *Plasmodium vivax* malaria is limited because the parasite cannot develop inside its mosquito host at temperatures below 14–16°C (Gilles, 1993). Further, blood-feeding arthropods feed and reproduce only above certain temperatures and need less time to complete their life cycle as temperatures increase above that threshold (Curto de Casas and Carcavallo, 1984; Burgos *et al.*, 1994). Threshold effects also apply to the life cycle of the infecting parasite.
- Some animal and plant populations would be unable to migrate or adapt behaviorally to climate change, in part because of constraints imposed by non-climate

variables such as day-length and soil type. Other species with either migratory or dispersive activity (particularly arthropod and weed pests in agriculture and disease vectors that affect human health) would cope with the shifts in climate zones. Humans generally would be less sensitive to changes in background climate because of their capacity to adapt via culture, technology, migration, and behavior.

- The sensitivity of health-outcome response depends on population susceptibility. For example, the impact of a climate-related increase in exposure to infectious agents would depend on prior contact (i.e., herd immunity), on general biological resilience (especially nutritional and immune status), and on population density and patterns of interpersonal contact. Social infrastructure and health-care resources also would condition the impact. In general, the most vulnerable populations or communities would be those living in poverty, with a high prevalence of undernutrition, chronic exposure to infectious disease agents, and inadequate access to social and physical infrastructure.

Table 18-1 lists illustrative examples of the relative sensitivity of selected human health responses to key aspects of climate change. It also summarizes what is known about thresholds in those responses. Further, the "conditionality" of response (i.e., the extent to which it is modulated by other influences) is indicated. This latter criterion is important: Many factors (including the intrinsic vulnerability of the local population) influence the determination of health status, and many of these would condition the health impact of climate change.

Further, many of the impacts of climate change would depend on parameters other than the central changes in mean values. For example, weather variability would be important for extreme events; rates of change would influence the production in ecosystems (e.g., agriculture and fisheries); and the ecology of infectious disease vectors is sensitive to many aspects of climate, including changes in the day-night differential in temperature. These aspects of climate change would vary in their relative importance for different health impacts, as illustrated in Table 18-2. However, information on such details is still rather incomplete.

18.1.4. Major Trends in World Health: Backdrop to Climate Change Impacts

Information about levels and time trends in specific health outcomes facilitates both the prediction and the appraisal of the health impacts of climate change. For example, patterns of malaria and malnutrition are changing around the world in response to various other changes in social, biological, and ecological circumstances. Any predicted impact of climate change upon such health outcomes should be assessed either by differentiating that impact from those of other independent background trends or, if appropriate, by assessing its interactive impact with those other, coexisting influences.

The main contemporary features of world health (World Bank, 1993; Murray and Lopez, 1994) are as follows: (1) near-worldwide increases in life expectancy [with the ex-Eastern Bloc countries standing in sharp recent contrast (Feachem, 1994)], (2) a decline in infant and child mortality in most developing countries, (3) persistent gradients in health status between rich and poor (within and between populations), (4) reductions in certain vaccine-preventable diseases (e.g., polio and measles), (5) increases in the chronic noninfectious diseases of adult life

Table 18-1: Examples of important aspects of the relationship of selected health outcomes to climate change.

Health Outcome	**Sensitivity**[a]	**Conditionality**[b]	**Thresholds**
Climate Stress/Mortality	+++	++	Temperature 33°C[c]
Climate Stress/Morbidity	+		
Allergy	++	++	Not applicable
Asthma	+	+	Not applicable
Vector-Borne Diseases (malaria, yellow fever, dengue, onchocerciasis, encephalitis)[d]	++(+)	++++	Temperature isotherms and humidity levels (bioclimatic functions) e.g., 1C°C: *Ae.* mosquito, 14–16°C: *P. vivax* parasite
Other Infectious Diseases (e.g., cholera)	+(++)		Temperature thresholds for algal and bacterial proliferation in sea- and freshwater—optimal ranges

++++ = great effect, + = small effect, (+) = possible additional effect

[a] Extent of change in health outcome per unit change in climate (equivalent to "slope" of regression line).

[b] Extent to which sensitivity depends on preceding and coexistent circumstances (i.e., notions of vulnerability/susceptibility and interactive effects).

[c] Based principally on northeastern U.S. data. Critical temperature depends on local climate and population acclimatization.

[d] See also Table 18-3.

***Table 18-2:** Probable relative impact on health outcomes of the aspects of climate change.*

Health Outcome	Aspects of Climate Change Change in Mean Temperature	Extreme Events	Rate of Change of Climate Variable	Day-Night Difference
Heat-Related Deaths and Illness		+++		+
Physical and Psychological Trauma due to Disasters		++++		
Vector-Borne Diseases	+++	++	+	++
Other Infectious Diseases	+	+		
Food Availability and Hunger	++	+	++	
Consequences of Sea-Level Rise	++	++	+	
Respiratory Effects				
– Air Pollutants	+	++		+
– Pollens, Humidity	++			
Demographic Disruption	++	+	+	

Notes: ++++ = great effect, + = small effect; empty cells indicate no known relationship.

(especially heart disease, diabetes, and certain cancers) in urban middle classes in rapidly developing countries, and (6) widespread increases in HIV infection. Rates of disease and death from cigarette smoking are likely to escalate markedly in many countries over the coming decades, as the tobacco industry takes advantage of freer trade and market-based economies (Peto *et al.*, 1994). In many urban populations, drug abuse and violence are increasing.

There appears to be a widespread increase in the tempo of new and resurgent infectious diseases (Levins *et al.*, 1994). This primarily reflects the combination of environmental and demographic changes in the world, plus increases in antibiotic and drug resistance, pesticide resistance, and decreased surveillance (Morse, 1991; CDC, 1994a). The interaction of local climate change with other disruptions of ecosystems may have facilitated various infectious disease outbreaks: the emergence of rodent-borne hantavirus pulmonary syndrome in the United States during 1992–3; various rodent-borne arenaviruses in Africa and South America; the spread of harmful algal blooms—and its association with cholera (which is now affecting more nations worldwide than at any earlier time this century); the rapid resurgence of dengue in the Americas since 1981; and the occurrence of dengue and malaria at higher altitudes than previously recorded (Levins *et al.*, 1994).

Many other important influences on population health are changing over time. For example, new vaccines are being developed, and existing ones are being used more widely; contraception is becoming more widely used, with benefits to maternal and child health; and safe drinking water is becoming available, albeit slowly, to an increasing proportion of householders in poorer countries. Other adverse effects (from cigarettes, drugs, urban traffic, social breakdown, violence, etc.) are increasing widely, and persistent widespread poverty remains a major structural impediment to improved health (WHO, 1995a). Against this complex balance sheet, it is inevitably difficult to estimate the likely net impact on population health status after the additional inclusion of climate change.

18.2. Potential Direct Health Impacts of Climate Change

The direct effects of climate change upon health result from changes in climate characteristics or short-term weather extremes that impinge directly on human biology. The following subsections deal with the health impacts of thermal stress and extreme weather events.

18.2.1. Health Impacts of Altered Patterns of Thermal Stress

Many studies, particularly in temperate countries, have observed a J-shaped relationship (often more generally referred to as a U-shaped relationship) between daily outdoor temperature and daily death rate: Mortality is lowest within an intermediate comfortable temperature range. The graph is not symmetrical; the death rate increases much more steeply with rising temperatures, above this comfort zone, than it does with falling temperatures below that zone (Longstreth, 1989; Kalkstein, 1993; Kunst *et al.*, 1993; Touloumi *et al.*, 1994). Relatedly, death rates in temperate countries appear to be affected across a wider band of decreasing, cold, temperatures than that for increasing, hot, temperatures (Kilbourne, 1992; Kunst *et al.*, 1993). Because death rates in temperate and subtropical zones are higher in winter than in summer (Kilbourne, 1992), it is a reasonable expectation that milder winters in such countries would entail a reduction in cold-related deaths and illnesses. However, since summer-related deaths appear to be more related to temperature extremes than are winter-related deaths, this reduction may not fully offset the heat-related increases. Further, this balance of gains and losses would vary among geographic regions and different populations. The issue of balance is examined further later in this section.

Quantitative interpretation of the impacts of altered daily-temperature distribution also is hampered by the fact that, for both heat-related and cold-related deaths, many of the apparent excess deaths occur in already-vulnerable persons (especially the elderly and the sick). Some analyses indicate that, in the absence of extreme temperatures, many of those persons would have died in the near future. This "mortality displacement" issue also will be considered further.

Global warming is predicted to increase the frequency of very hot days (see Chapter 6, *Climate Models–Projections of Future Climate*, of the IPCC Working Group I volume). The frequency of such days in temperate climates (e.g., USA, UK, Australia) would approximately double for an increase of 2–3°C in the average summer temperature (e.g., CDC, 1989; Climate Change Impacts Review Group UK, 1991). Extensive research has shown that heat waves cause excess deaths (Weihe, 1986; Kilbourne, 1992). Recent analyses of concurrent meteorological and mortality data in cities in the United States, Canada, the Netherlands, China, and the Middle East provide confirmatory evidence that overall death rates rise during heat waves (Kalkstein and Smoyer, 1993; Kunst *et al.*, 1993), particularly when the temperature rises above the local population's threshold value. Therefore, it can be predicted confidently that climate change would, via increased exposure to heat waves, cause additional heat-related deaths and illnesses (Kalkstein, 1993; Haines *et al.*, 1993).

The effect of extreme heat on mortality is exacerbated by low wind, high humidity, and intense solar radiation (Kilbourne, 1992). Indeed, these meteorological elements can be treated synoptically, to evaluate the net impact of weather on human health. For example, recent studies in the United States have described "oppressive" air masses (analogous to the meteorologist's "stagnating" air masses), which represent synoptic meteorological situations that exceed physiological tolerance levels. This approach recognizes that humans principally respond to the umbrella of air that surrounds them rather than to individual meteorological elements (Kalkstein, 1993). It also should be noted that concurrent hot weather and air pollution have interactive impacts on health (Katsouyanni *et al.*, 1993; see also Section 18.3.5).

Healthy persons have efficient heat regulatory mechanisms that cope with increases in temperature up to a particular threshold. The body can increase radiant, convective, and evaporative heat loss by vasodilation (enlargement of blood vessels in the skin) and perspiration (Horowitz and Samueloff, 1987; Diamond, 1991). Further, some acclimatization to persistent oppressive weather conditions can occur within several days (Kilbourne, 1992). Nevertheless, the risk of death increases substantially when thermal stress persists for several consecutive days (Kalkstein and Smoyer, 1993). The elderly and very young are disproportionately affected because of their limited physiological capacity to adapt. Although some individuals die from heat exhaustion or heatstroke, the deaths associated with very hot weather are predominantly associated with preexisting cardiovascular and respiratory disorders, as well as accidents (Larsen, 1990a, 1990b). Although there is less evidence on nonfatal illness episodes, it is a reasonable general assumption that thermal stress also increases rates of morbidity.

Socioeconomic factors may have important modulating effects on thermal stress-related mortality. From studies in the United States, the extent of protection from air conditioning remains unclear (Ellis and Nelson, 1978; Larsen, 1990a; Rogot *et al.*, 1992; Kalkstein, 1993). Of more general importance, people living in poverty, including segments of many urban populations in developing countries, are particularly vulnerable to heat stress. Poor housing, the urban heat island effect, and lack of air conditioning are among the primary causes (Kilbourne, 1989). Complete acclimatization may take up to several years (Babeyev, 1986), rendering immigrants (e.g., rural-to-urban) vulnerable to weather extremes for a considerable time. Ongoing rapid increases in urbanization (see Chapter 12) will increase the number of vulnerable persons.

The question in relation to the abovementioned notion of "mortality displacement" is: Would some of those who die during heat waves have succumbed soon afterward from preexisting frailty or disease (Kalkstein, 1993; U.S. EPA, in press)? Various time-series analyses indicate a "deficit" in daily deaths for up to a month after heat waves (e.g., Figure 18-2), and U.S.-based reşearch suggests that 20–40% of the deaths occurring during heat waves would have occurred within the next few weeks (Kalkstein, 1993). A related uncertainty is whether, as the frequency of heat waves increases, the mortality excess remains constant or whether, as some research suggests, successive heat waves entail a progressive lessening of the associated mortality peak.

Kalkstein (1993) made predictions of heat-related mortality for selected urban populations in North America, North Africa, and East Asia in relation to IPCC-specified climate-change scenarios. This entailed, first, identifying for each population

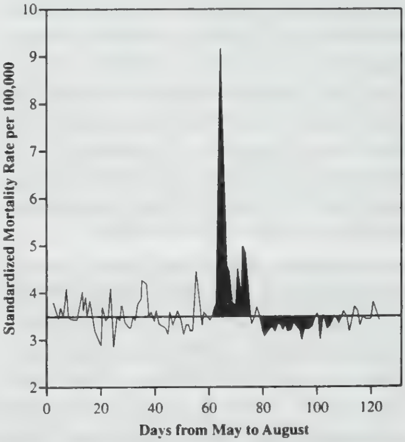


Figure 18-2: Daily summer mortality during a New York heatwave, 1966 (Kalkstein, 1993)

setting the synoptic weather situations that are "oppressive" (i.e., exceed physiological tolerance levels). The annual number of oppressive synoptic situation days was then predicted for the climate-change scenarios, and the annual total of associated excess deaths was estimated. Model-based predictions of the numbers of additional deaths attributable to heat during a typical summer in a future warmer world were thus obtained. Two sets of predicted mortality increases were made: one assuming that the population does not acclimatize and the other assuming partial acclimatization (i.e., complete physiological acclimatization but without improved socioeconomic conditions such as the development of more protective housing).

Consider the population of Atlanta, for example. Presently, Atlanta experiences an average of 78 heat-related deaths each summer. Under the climate projections of the Geophysical Fluid Dynamics Laboratory (GFDL) 1989 (transient) climate-change model, and assuming no change in population size or age profile, this number would increase to 191 in the year 2020 and to 293 in the year 2050. If population acclimatization occurs, the annual total would increase less, to 96 and 147 in those two years. Under the UKTR (transient) model run, the corresponding four projections of heat-related mortality are 20–40% higher than for the GFDL model run: 247 and 436 deaths (unacclimatized, 2020 and 2050) and 124 and 218 deaths (acclimatized, 2020 and 2050). These and other results for selected North American cities, Shanghai, and Cairo indicate that the annual number of heat-related deaths would, very approximately, double by 2020 and would increase several-fold by 2050. Thus, in very large cities with populations displaying this type of sensitivity to heat stress, climate change would cause several thousand extra heat-related deaths annually.

As mentioned earlier, the seasonal death rates in developed countries are highest in winter (Kilbourne, 1992; Tan, 1994). In temperate-zone countries, death rates increase particularly during periods of severe winter weather. However, no single study has yet been published that allows a direct comparison of the anticipated winter gains and summer losses that would accompany global warming. A substantial proportion of winter-related deaths are from cardiovascular disease (Kunst *et al.*, 1993; Langford and Bentham, 1995). It is likely that this increased risk of cardiovascular disease reflects an increased cold-induced tendency for blood to clot (Keatinge *et al.*, 1989), perhaps exacerbated by the fibrinogen-enhancing effect of winter respiratory infections (Woodhouse *et al.*, 1994). The relative importance of respiratory infections and cardiovascular diseases to anticipated reductions in mortality, and how these would vary geographically, remains uncertain. One recent British study has forecast that approximately 9,000 fewer winter-related deaths (estimated to represent a reduction of 2–3%) would occur annually by the year 2050 in England and Wales, under typical climate-change scenarios that entail 2–2.5°C wintertime increases (Langford and Bentham, 1995). Just over half the avoided deaths would be from ischaemic heart disease and stroke, with chronic bronchitis and pneumonia each contributing 5–10%. Other researchers have concluded that a significant portion of the overall winter-related mortality is due to respiratory infections such as influenza (Curwen, 1991). Since these respiratory infections depend upon aerosol transmission—usually in confined, poorly ventilated places—a small rise in winter temperatures should reduce this risk if it encouraged outdoor activities and improved ventilation. However, annual influenza outbreaks do not appear to correlate with mean winter or monthly temperature (CDC, 1994b; Langford and Bentham, 1995).

Overall, the sensitivity of death rates to hotter summers is likely to be greater than to the accompanying increase in average winter temperature. The overall balance is difficult to quantify, and also would depend on the population's capacity for adaptive responses. However, research to date suggests that global warming would, via an increased frequency of heat waves, cause a net increase in mortality and associated morbidity. This conclusion must be qualified by noting that there is an imbalance in the published research—most of which refers to developed, non-tropical, countries.

18.2.2. Health Impacts of Weather Variability and Extreme Events

Global warming may affect ocean currents, air currents, and atmospheric humidity (see Chapter 6, *Climate Models–Projections of Future Climate*, of the IPCC Working Group I volume). Any consequent changes in weather variability may alter the frequency and severity of extreme weather events: bushfires, droughts, floods, storms, and landslides (Gordon *et al.*, 1992; Meehl *et al.*, 1992). However, some of these relationships remain uncertain (e.g., for tropical cyclones; see Lighthill *et al.*, 1994) and have proven difficult to model with GCMs. Such events increase deaths, injuries, infectious diseases, stress-related disorders, and the many adverse health effects associated with social disruption, environmentally enforced migration (Myers, 1993), and settlement in urban slums. Health impacts would be greatest on those communities that are most exposed and have the fewest technical and social resources.

Low-lying, poorly resourced populations would be particularly vulnerable to an increase in frequency of storms and storm surges. In the 1970 Bangladesh cyclone, mortality varied from around 5% inland to almost 50% in coastal communities. Widespread destruction of food supplies may also occur; in 1970, two-thirds of fishing activities along the coasts and plains in Bangladesh were destroyed, along with 125,000 animals (Alexander, 1993). In Andhra Pradhesh, India, in 1970, many victims died when wind and rain caused the collapse of houses (Sommer and Mosely, 1972).

Flash floods and landslides (see Chapter 12) would increase in frequency in regions experiencing increased torrential rainfall. Heavy rains can erode soil, thereby impairing agricultural productivity. Flooding also can affect the incidence of vector-borne diseases. On the one hand, flood waters may wash away mosquito eggs/larvae; on the other hand, residual water may increase mosquito populations and consequent infectious diseases. In southeastern Australia, epidemics of Ross River virus infection follow heavy rains in the Murray-Darling basin (Nicholls, 1993). Flooding also may affect the transmission of diarrheal diseases: In Bolivia, for example, flooding associated with El Niño in 1983 led to a 70% increase in salmonella infections, particularly in children (Telleria, 1986).

Flash flooding is a leading cause of weather-related mortality in the United States (French and Holt, 1989). Damage to homes and displacement of residents may facilitate the spread of infectious diseases because of crowded living conditions. Flooding can contaminate water sources with fecal material or toxic chemicals. Flooding also increases runoff from agricultural lands and urban stormwater systems (Thurman *et al.*, 1991, 1992). Water resources thus are contaminated by toxic chemical wastes, agricultural chemicals, and pathogens (e.g., *Cryptosporidium*). Hazardous exposure may arise from contaminated drinking water and from edible fish that bioaccumulate contaminants.

The many psychosocial effects of natural disasters have been studied in survivors of storms, floods, earthquakes, and fires (e.g., Gregg, 1989). Severe disturbance (including "post-traumatic stress disorder") usually affects only a minority, many of whom recover (de Girolamo and McFarlane, 1994)—although children in affected families may show developmental problems over the ensuing years (Titchener and Frederic, 1976). The level of psychological impact may depend upon the suddenness and unexpectedness of the impact, the intensity of the experience, the degree of personal and community disruption, and long-term exposure to the visual signs of the disaster (Green, 1982; Green *et al.*, 1991). Data from disasters in developing countries are sparse, but a follow-up study after the disastrous 1988 floods in Bangladesh showed increased behavioral disorders in young children (Durkin *et al.*, 1993).

Two final comments on extreme events are appropriate here. First, a major effect of extreme climatic events on human health has been malnutrition and starvation due to severe drought and its consequences (Escudero, 1985). This, in turn, causes increased susceptibility to infection (Tomkins, 1986). Second, there is evidence that environmental degradation, unequal access to resources, and population growth may be potent factors in provoking conflict (Homer-Dixon *et al.*, 1993). By affecting water and food supply, climate change could increase the possibility of violent conflicts in a number of regions.

18.3. Potential Indirect Health Impacts of Climate Change

The indirect effects of climate change upon health are those that do not entail a direct causal connection between a climatic factor (such as heat, humidity, or extreme weather event) and human biology.

18.3.1. Vector-Borne Diseases

The transmission of many infectious diseases is affected by climatic factors. Infective agents and their vector organisms are sensitive to factors such as temperature, surface water, humidity, wind, soil moisture, and changes in forest distribution (Bradley, 1993). This applies particularly to vector-borne diseases (VBDs) like malaria, which require an intermediate organism such as the mosquito to transmit the infective agent. It is therefore projected that climate change and altered weather patterns would affect the range (both latitude and altitude), intensity, and seasonality of many vector-borne and other infectious diseases. In general, increased warmth and moisture would enhance transmission of these diseases. However, any such climate-related redistribution of disease may also entail—perhaps in conjunction with other environmental stresses—some localized reductions in rates of infection.

The sustained (or endemic) transmission of VBDs requires favorable climatic-environmental conditions for the vector, the parasite, and, if applicable, the intermediate host species. For vectors with long life spans (e.g., tsetse flies, bugs, ticks), vector abundance is a major determinant of disease distribution; arthropods that transmit VBDs generally thrive in warmth and moisture. For vectors with short life spans (e.g., mosquitoes, sandflies, blackflies), the temperature-sensitive extrinsic maturation period of the parasite is of critical importance. The geographic distributions of many of the parasites, both unicellular (protozoa) and multicellular (e.g., flukes and worms), correlate closely with temperature (Gillet, 1974; Shope, 1991). The geographic distributions of vector-borne viral infections, such as dengue and yellow fever, are affected by temperature and surface water distribution. For many VBDs, such as plague and hantavirus, rodents act as intermediate infected hosts or as hosts for the arthropod vector (Wenzel, 1994); rodent activity would also tend to increase in a warmer world (Shope, 1991).

In tropical countries, VBDs are a major cause of illness and death. For the major VBDs, estimates of numbers of people at risk and infected, and of VBD sensitivity to climate change, are shown in Table 18-3. While the potential transmission of many such diseases would increase (geographically or from seasonal to year-round) in response to climate change, the capacity to control these diseases also will change. New or improved vaccines can be expected; some vector species can be constrained by use of pesticides. Nevertheless, there are uncertainties and risks here, too: for example, long-term pesticide use breeds resistant strains and kills many predators of pests.

18.3.1.1. Malaria

Malaria remains a huge global public-health problem, currently causing around 350 million new infections annually, predominantly in tropical countries. Malaria is caused by an infective parasite (plasmodium) transmitted between humans by a mosquito vector. Its incidence is affected by temperature, surface water, and humidity (Gill, 1920a, 1920b; Sutherst, 1983). Although anopheline mosquito species that transmit malaria do not usually survive where the mean winter temperature drops below 16–18°C, some higher-latitude species are able to hibernate in sheltered sites. Sporogonic development (i.e., the extrinsic incubation phase of

***Table 18-3:** Major tropical vector-borne diseases and the likelihood of change of their distribution with climate change.*

Disease	**Vector**	**Population at Risk (million)**[a]	**Number of People Currently Infected or New Cases per Year**	**Present Distribution**	**Likelihood of Altered Distribution with Climate Change**
Malaria	Mosquito	2,400[b]	300–500 million	Tropics/Subtropics	+++
Schistosomiasis	Water Snail	600	200 million	Tropics/Subtropics	++
Lymphatic Filariasis	Mosquito	1,094[c]	117 million	Tropics/Subtropics	+
African Trypanosomiasis (Sleeping Sickness)	Tsetse Fly	55[d]	250,000–300,000 cases per year	Tropical Africa	+
Dracunculiasis (Guinea Worm)	Crustacean (Copepod)	100[e]	100,000 per year	South Asia/ Arabian Peninsula/ Central-West Africa	?
Leishmaniasis	Phlebotomine Sand Fly	350	12 million infected, 500,000 new cases per year[f]	Asia/Southern Europe/Africa/ Americas	+
Onchocerciasis (River Blindness)	Black Fly	123	17.5 million	Africa/Latin America	++
American Trypanosomiasis (Chagas' disease)	Triatomine Bug	100[g]	18 million	Central and South America	+
Dengue	Mosquito	1,800	10–30 million per year	All Tropical Countries	++
Yellow Fever	Mosquito	450	<5,000 cases per year	Tropical South America and Africa	++

+ = likely, ++ = very likely, +++ = highly likely, ? = unknown.

[a] Top three entries are population-prorated projections, based on 1989 estimates.

[b] WHO, 1995b.

[c] Michael and Bundy, 1995.

[d] WHO, 1994a.

[e] Ranque, personal communication.

[f] Annual incidence of visceral leishmaniasis; annual incidence of cutaneous leishmaniasis is 1-1.5 million cases/yr (PAHO, 1994).

[g] WHO, 1995c.

the plasmodium within the mosquito) ceases below around 18°C for *Plasmodium falciparum* and below 14°C for *P. vivax*. Above those temperatures, a small increase in average temperature accelerates the parasite's extrinsic incubation (Miller and Warrell, 1990). Temperatures of 20–30°C and humidity above 60% are optimal for the anopheline mosquito to survive long enough to incubate and transmit the parasite.

Until recent decades, parts of today's developed world were malarious. These included the United States, southern Europe, and northern Australia. In the last century, outbreaks of *P. vivax* malaria occurred in Scandinavia and North America. Although climate change would increase the potential transmission of malaria in some temperate areas, the existing public-health resources in those countries—disease surveillance, surface-water management, and treatment of cases—would make reemergent malaria unlikely. Indeed, malaria is most likely to extend its spread (both latitude and altitude) and undergo changes in seasonality in tropical countries, particularly in populations currently at the fringe of established endemic areas (Martens *et al.*, 1994). Newly affected populations would initially experience high case fatality rates because of their lack of natural acquired immunity.

Box 18-1. Examples of Modeling the Future Impact of Climate Change upon Malaria

Mathematical models have been recently developed for the quantitative prediction of climate-related changes in the potential transmission of malaria (e.g., Sutherst, 1993; Matsuoka and Kai, 1994; Martin and Lefebvre, 1995). Note the use of the important word "potential" here; the models are primarily predicting where malaria could occur as a function of climate and associated environment, irrespective of the influence of local demographic, socioeconomic, and technical circumstances.

A simple model has been used for Indonesia, based on empirical historical data from selected provinces on the relationship of annual average temperature and total rainfall to the incidence of malaria (and dengue and diarrhea) (Asian Development Bank, 1994). The model forecasts that annual malaria incidence (currently 2,705 per 10,000 persons) would, in response to the median climate-change scenario, increase marginally by 2010 and by approximately 25% by 2070. Because of the limited technical information, it is not easy to appraise these particular forecasts.

A more complex integrated global model has been developed by Martens *et al.* (1994). This model takes account of how climate change would affect the mosquito population directly—i.e., mosquito development, feeding frequency, and longevity—and the incubation period of the parasite inside the mosquito (see Figure 18-3). As a highly aggregated model, it does not take account of local environmental-ecological factors, and it therefore cannot be regarded as a source of precise projections. The model's output refers to geographic changes in *potential* transmission (i.e., the range within which both the mosquito and parasite could survive with sufficient abundance for sustained transmission of malaria). This is not, therefore, a projection of actual disease incidence, and it must be interpreted in relation to local control measures, health services, parasite reservoir, and mosquito densities. Further, until such models have been validated against historical data sets, their predictions must be viewed cautiously.

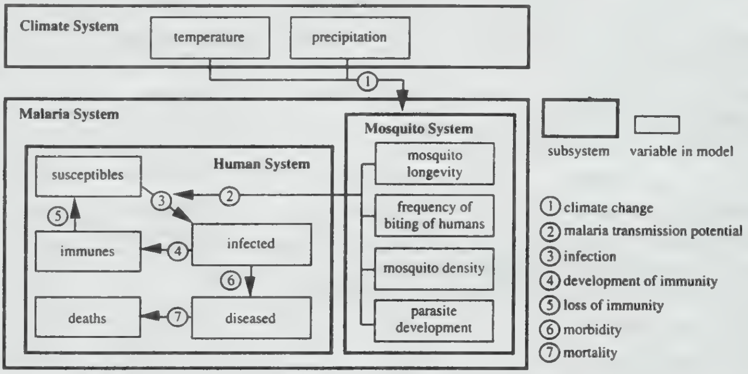


Figure 18-3: Systems diagram of a model designed to assess the impact of climate change on the potential transmission of malaria (adapted from Martens *et al.*, 1994).

This particular model predicts widespread increases in the potential habitat range and the "vectorial capacity" of the mosquito, and therefore potential malaria transmission, in response to climate change. For example, using GCM predictions of 3–5°C increases in global mean temperature by the year 2100, the malaria epidemic potential of the mosquito population is estimated to increase twofold in tropical regions and substantially more than tenfold in temperate climates (Martens *et al.*, 1995a). Overall, there is an increase from around 45% to around 60% of the world population living within the potential malaria transmission zone by the latter half of the next century. However, most of the developed countries have effective control and surveillance measures that should preclude reintroduction of endemic malaria. In the already endemic areas, especially in the subtropics, malaria may increase (although in some hot climates, further temperature increases may shorten the life span of mosquitoes, and local malaria transmission would then decrease). In particular, in adjoining areas of lower endemicity or unstable malaria, the occurrence of infection is far more sensitive

Box 18-1 (continued)

to climate variation, so climate change may have a marked effect on its incidence and stability. Simulations with this model, using several different GCMs, predict a climate-induced increase in the incidence of annual malaria cases of approximately 50–80 million in response to a temperature rise of around 3°C by the year 2100, relative to an assumed approximate base of 500 million annual cases in a 2100 world without climate change (Martens *et al.*, 1995b).

Another recent attempt at aggregated global modeling (Martin and Lefebvre, 1995) has predicted that potential malaria transmission would spread to higher latitudes, while some currently stable endemic areas near the equator would become unstable, leading to reductions in population immunity levels.

Such models, despite their highly aggregated predictions and simplifying assumptions, provide indicative information about the likely impact of climate change on the potential transmission of vector-borne diseases (assuming that other relevant factors remain constant). There is a clear need for validation of these models and for incorporating more extensive detail into them. Meanwhile, this line of research has begun to elucidate the interdependent relationships among climate change, vector population dynamics, and human disease dynamics.

Recent evidence of the responsiveness of malaria incidence to local climate change comes from observations of marked increases in malaria incidence in Rwanda in 1987, when atypically hot and wet weather occurred (Loevinsohn, 1994), and annual fluctuations in falciparum malaria intensity in northeast Pakistan that correlated with annual temperature variations during the 1980s (Bouma *et al.*, 1994). Hence, it is a reasonable prediction that, in eastern Africa, a relatively small increase in winter temperature could extend the mosquito habitat and thus enable falciparum malaria to reach beyond the usual altitude limit of around 2,500 m to the large, malaria-free, urban highland populations, e.g., Nairobi in Kenya and Harare in Zimbabwe. Indeed, the monitoring of such populations around the world, currently just beyond the boundaries of stable endemic malaria, could provide early evidence of climate-related shifts in malaria distribution (Haines *et al.*, 1993).

18.3.1.2. African Trypanosomiasis

African trypanosomiasis, or "sleeping sickness," is transmitted by tsetse flies. The disease is a serious health problem in tropical Africa, being generally fatal if untreated. Research in Kenya and Tanzania shows only a very small difference in mean temperature between areas where the vector, *Glossina morsitans*, does and does not occur. This indicates that a small change in temperature may significantly affect the limits of the vector's distribution (Rogers and Packer, 1993).

18.3.1.3. American Trypanosomiasis (Chagas' Disease)

American trypanosomiasis is transmitted by insects of the subfamily *Triatominae*. It is a major problem in Latin America, with 100 million people at risk and 18 million infected (WHO, 1995c). An estimated 15–20% of infected people develop clinical Chagas' disease. Most of the triatomine vector species need a minimum temperature of 20°C for feeding and reproduction (Curto de Casas and Carcavallo, 1984), but at higher temperatures (28–30°C) they feed more frequently, have a shortened life cycle, and an increased population density (Carcavallo and Martinez, 1972, 1985). At even higher temperatures, the most important vector species, *Triatoma infestans*, doubles its reproductive rate (Hack, 1955).

18.3.1.4. Schistosomiasis

Schistosomiasis is a water-based disease caused by five species of schistosomal flukes. Water snails act as the intermediate host (and, strictly speaking, are not active "vectors"). The infection has increased in worldwide prevalence since mid-century, perhaps largely because of the expansion of irrigation systems in hot climates, where viable snail host populations interact with infected humans (White *et al.*, 1972; Grosse, 1993; Hunter *et al.*, 1993).

Data from both the field and the laboratory indicate that temperature influences snail reproduction and growth, schistosome mortality, infectivity and development in the snail, and human-water contact (Martens *et al.*, 1995b). In Egypt, for example, water snails tend to lose their schistosome infections during winter, but if temperatures increase, snails may mediate schistosomiasis transmission throughout the year (Gillet, 1974; WHO, 1990). Predictive modeling indicates that a change in background temperatures may cause the infection to extend to currently unaffected regions. Fluctuations in temperature may also play an important role in optimizing conditions for the several life-cycle stages of schistosomiasis (Hairston, 1973).

18.3.1.5. Onchocerciasis (River Blindness)

Onchocerciasis, or "river blindness," is a VBD affecting approximately 17.5 million people—some in Latin America, most in West Africa. The vector is a small blackfly of the genus *Simulium*, and the infectious agent is the larva of the *Onchocerca volvulus* parasite. This threadlike worm damages the skin, the lymphatic system, and, in the most extreme cases, the eye. Climate affects the occurrence of onchocerciasis because the vector requires fast-flowing water for successful reproduction (WHO, 1985), and the adult vector can be spread by wind.

A recent simulation study on the potential impact of climate change on blackfly populations in West Africa showed that if temperature and precipitation were to change across parts of the sub-Sahel, as predicted by the Goddard Institute for Space Studies (GISS) GCM (Hansen *et al.*, 1988), blackfly populations may increase by as much as 25% at current breeding sites (Mills, 1995). Since these vectors can travel hundreds of kilometers on wind currents, new habitats in previously unsuitable areas could be quickly colonized by blackflies, introducing onchocerciasis into new areas (Garms *et al.*, 1979; Walsh *et al.*, 1981; WHO, 1985).

18.3.1.6. Trematode Infections

Some trematode infections, such as fascioliasis (a liver fluke that currently affects around 2.4 million persons), would be affected by climate changes because the life cycle and population size of the snail host are very sensitive to temperature. Similarly, the incidence of cercarial dermatitis (skin inflammation) would be increased at higher temperatures. This infection is currently found in Europe (Beer and German, 1994) and the United States (CDC, 1992), where it causes "swimmer's itch"; its incidence has recently increased in Russia (Beer and German, 1993) and in very poor rural communities in developing countries.

18.3.1.7. Vector-Borne Viral Infections

Many vector-borne infective agents are viruses. The human-infecting arboviruses (i.e., arthropod-borne viruses) generally have a mosquito vector. Arboviral infections span a wide clinical spectrum, from those that cause mild feverish illness or subclinical infections to those causing severe and often fatal encephalitis (brain inflammation) or hemorrhagic fever. Under favorable environmental conditions, an arboviral disease can become epidemic (population-wide), from a local endemic base or by its introduction to a previously unaffected area. The distribution and abundance of vectors are influenced by various physical factors (temperature, rainfall, humidity, and wind) and biological factors (vegetation, host species, predators, parasites, and human interventions) (WHO, 1990). Temperature also affects the rapidity of the virus' life cycle—e.g., the extrinsic incubation period for the mosquito-hosted stage of the yellow fever virus varies from several weeks to 8–10 days, depending on temperature.

Increased temperature and rainfall in Australia would influence the range and intensity of various vector-borne viral infections. For example, certain arthropod vectors and natural vertebrate hosts would spread southward and proliferate in response to warming and increased rain, resulting in increased incidence of arboviral infections such as Murray Valley encephalitis (which can cause serious brain damage), Ross River virus (which causes multiple, often long-lasting joint inflammation), and dengue (e.g., Sutherst, 1993; Nicholls, 1993).

Dengue is a severe influenza-like disease, which in some cases may take the form of a hemorrhagic fever, which can cause an average of 15% mortality without proper medical attention. Dengue is transmitted by the *Aedes aegypti* mosquito, as is urban yellow fever. In parts of Asia, dengue also is transmitted by *Ae. albopictus*, which now is colonizing North and South America. Research in Mexico has shown that an increase of 3–4°C in average temperature doubles the rate of transmission of the dengue virus (Koopman *et al.*, 1991). Although there is no clear evidence of regional climatic influence, annual epidemics of dengue have returned to Central America over the past decade (as they did about twenty years ago in Asia), and, in Mexico, dengue has recently spread to previously unaffected higher altitudes (Herrera-Basto *et al.*, 1992). *Ae. aegypti* mosquitoes, once limited to 1,000 meters altitude by temperature in Çolombia, have been recently reported above 2,200 meters. The habitat of the mosquito is restricted to areas with a mean midwinter temperature of more than 10°C. Epidemic transmission of dengue is seldom sustained at temperatures below 20°C (Halstead, 1990).

18.3.1.8. Other Vector-Borne Diseases

VBDs are now relatively rare in most developed countries; however, it has been predicted that various VBDs might enter or increase in incidence in the United States because of higher temperatures (Longstreth, 1989; Freier, 1993; Martens *et al.*, 1994); Venezuelan equine encephalitis, dengue, and leishmaniasis could extend into the southern United States; Western equine encephalitis might move further north within the United States (Reeves *et al.*, 1994). The dengue-transmitting *Ae. albopictus* mosquito, which is more cold-hardy than *Ae. aegypti*, is now well established in the United States and may extend toward Canada if temperatures increase.

Climate change would influence the global pattern of VBDs via other disturbances of ecological relationships. For example, it would bring together vertebrate animals of different species and would thereby expose animals to new arthropod vectors. Warming (and rising sea levels) would displace some human populations, perhaps resulting in migration into wilderness areas where zoonotic infectious agents are being transmitted in silent wildlife cycles. Migratory humans would thus be at risk of infection with enzootic (i.e., locally prevalent animal-infecting) agents. Climate-induced changes in ecology also could force the rapid evolution of infectious agents, with newly emergent strains of altered virulence or pathogenicity. Additionally, changes in climate means and variability can disrupt predator/prey ratios, thus loosening natural controls on pests and pathogens.

Two other general points should be noted. First, because vector control methods exist for many of these diseases, developed countries should be able to minimize their impact. Second, however, the quicker "turnover" of the life cycle of parasites at higher temperatures will increase their likelihood of evolving greater resistance to drugs and other control methods. This would pose a particular problem to those tropical countries with high infection rates and limited socioeconomic resources.

18.3.2. Water-Borne and Food-Borne Infectious Diseases

Climatic effects on the distribution and quality of surface water—including increases in flooding and water shortages that concentrate organisms, impede personal hygiene, and impair local sewerage—would influence the risks of diarrheal (including cholera) and dysentery epidemics, particularly in developing countries. Diarrheal diseases can be caused by a large variety of bacteria (e.g., *Salmonella*, *Shigella*, and *Campylobacter*), viruses (e.g., *Rotavirus*), and protozoa (e.g., *Giardia lamblia*, amoebas, and *Cryptosporidium*). Many of these organisms can survive in water for months, especially at warmer temperatures, and increased rainfall therefore could enhance their transport between groups of people. An increased frequency of diarrheal disease is most likely to occur within impoverished communities with poor sanitation. There have been outbreaks of diarrheal disease after flooding in many such settings. If flooding increased, there also would be risks of outbreaks of infection in developed countries within temporary settlements of displaced communities.

The cholera organism, *Vibrio cholerae*, can survive in the environment by sheltering beneath the mucous outer coat of various algae and zooplankton—which are themselves responsive to climatic conditions and to nutrients from wastewater and fertilizers (Epstein, 1992; Smayda, 1990; Anderson, 1992). Increases in coastal algal blooms may therefore amplify *V. cholerae* proliferation and transmission. This might also assist the emergence of new genetic strains of vibrios. Algal blooms also are associated with biotoxin contamination of fish and shellfish (Epstein *et al.*, 1993). With ocean warming, toxins produced by phytoplankton, which are temperature-sensitive, could cause contamination of seafood more often (see also Chapter 16), resulting in increased frequencies of amnesic, diarrheic and paralytic shellfish poisoning and ciguatera poisoning from reef fish. Thus, climate-induced changes in the production of both aquatic pathogens and biotoxins may jeopardize seafood safety for humans, sea mammals, seabirds, and finfish.

Climate change also could create a problem via the warming of aboveground piped-water supplies. In parts of Australia, for example, there has been a seasonal problem of meningoencephalitis caused by the *Naegleria fowleri* amoeba, which proliferates in overland water pipes in summer (NHMRC, 1991). Soil-based pathogens (e.g., the tetanus bacterium and various fungi) would tend to proliferate more rapidly with higher temperature and humidity, depending on the effectiveness of microclimatic homeostatic mechanisms. Higher temperatures would also increase the problem of food poisoning by enhancing the survival and proliferation of bacteria, flies, cockroaches, and so forth in foodstuffs.

18.3.3. Agricultural Productivity and Food Supplies: Effects upon Nutrition and Health

Food, as energy and nutrients, is fundamentally important to health. Malnutrition is a major cause of infant mortality, physical and intellectual stunting in childhood, and immune impairment (thus increasing susceptibility to infections). Currently, around one-tenth of the world's population may be hungry (Parry and Rosenzweig, 1993) and a larger proportion malnourished—although estimates differ according to definition.

Human societies have evolved farming methods to counter various local climatic and environmental constraints on agriculture, especially via irrigation, fertilization, mechanization, and the breeding of better-adapted varieties. Today, as gains in per capita agricultural productivity appear to be diminishing, widespread land degradation accrues, and access to new arable land is declining, the further possibility exists of adverse effects of climate change upon aspects of world food production (Houghton *et al.*, 1990; Kendall and Pimentel, 1994). The impacts of climate change upon crop and livestock yield would be realized within a complex setting that encompasses climate change scenarios, crop yield response, pest population response, demographic trends, patterns of land use and management, and social and economic responses.

18.3.3.1. Modes of Climatic Impact upon Agricultural Productivity

Global warming would alter regional temperature and rainfall. Changes in these two major influences on agriculture, and consequent reductions in soil moisture, could impair the growth of many crops. Increases in the intensity of rainfall in some regions would exacerbate soil erosion. The net global impact of these climate-related changes upon food production is highly uncertain (Reilly, 1994). Although the IPCC assessment is uncertain about the overall impact, it foresees productivity gains and losses in different regions of the world (see Chapter 13). While productivity may increase initially, longer-term adaptations to sustained climate change would be less likely because of the limitations of plant physiology (Woodward, 1987).

Climate change also could affect agriculture by long-term changes in agroecosystems, by an increased frequency and severity of extreme events, and by altered patterns of plant diseases and pest infestations (e.g., Farrow, 1991; Sutherst, 1991). Debate persists over whether enrichment of the atmosphere with carbon dioxide will have a "fertilization effect" (Idso, 1990b; Bazzar and Fajer, 1992; Körner, 1993). Experiments consistently indicate that C_3 plants (e.g., wheat, soya beans, rice, and potatoes) would respond more positively than C_4 plants (e.g., millet, sorghum, and maize), which would be unaffected (see Chapter 13). This effect may be temperature-dependent (Vloedbeld and

Leemans, 1993). Such influences on the climatically optimal mix of crop species would disturb patterns of traditional agriculture in some regions.

18.3.3.2. Impacts upon Food Supplies, Costs, and the Risk of Hunger

Since climate change may threaten food security in poorer countries within the semi-arid and humid tropics (Rosenzweig *et al.*, 1993; see also Chapter 13), poorer countries, already struggling with large and growing populations and marginal climatic conditions, would be particularly vulnerable to food shortages, malnutrition, and demographic disruption. In such countries, there is minimal capacity for adaptive change (Leemans, 1992). Already in Africa, more than 100 million people are "food insecure," many of them in the arid Sahel region. The cost of food on world markets would increase if crop production declined in the world's mid-latitude breadbasket regions. The large minority of the world population that already suffers from malnutrition would then face an increased threat to health from agricultural failure and rising food costs. A recent analysis predicts an extra 40–300 million people at risk of hunger in the year 2060 because of the impact of climate change, on top of a predicted 640 million people at risk of hunger by that date in the absence of climate change (Rosenzweig *et al.*, 1993).

18.3.3.3. Impacts of Climate Change on Non-Cereal Food Production

Climate change may influence the production of noncrop food supplies, including animal productivity. For example, the U.S. Environmental Protection Agency has identified several infectious diseases—such as the horn fly in beef and dairy cattle and insect-borne anaplasmosis infection in sheep and cattle—that could increase in prevalence in response to climate changes (Rosenzweig and Daniel, 1989). An increase in temperature and temperature extremes also could affect the growth and health of farm animals (Furquay, 1989); young animals are much less tolerant of temperature variation than are adult animals (Bianca, 1976).

Changes in ocean temperatures and currents could affect the base of the marine food web and alter the distribution, migration, and productivity of fish species, a major source of protein for many human populations (Glantz, 1992). Increased soil erosion from intensified rainfall raises the turbidity of lakes and rivers, reducing photosynthesis and therefore fish nutrition. As in agriculture, climate change may contribute to the decline of some fisheries and the expansion of others (see Chapter 16).

18.3.4. Health Impacts of Sea-Level Rise

Each of the vast changes in sea level that have occurred during the past million years, before and after ice ages, typically took many thousands of years. The predicted rise of around half a meter over the next century (see Chapter 7, *Changes in Sea Level*, of the IPCC Working Group I volume) would be much faster than anything experienced by human populations since settled agrarian living began. Such a rise would inundate much of the world's lowlands, damage coastal cropland, and displace millions of persons from coastal and small island communities (see Chapter 12).

Much of coastal Bangladesh and Egypt's heavily populated Nile Delta would be flooded. Some low-lying, small island states such as the Maldives and Vanuatu would be at risk of partial immersion, and many other low-lying coastal regions (for example, eastern England, parts of Indonesia, the Florida Everglades, parts of the northeast coast of Latin America) would be vulnerable. The displacement of inundated communities—particularly those with limited economic, technical, and social resources—would greatly increase the risks of various infectious, psychological, and other adverse health consequences.

Sea-level rise could have a number of other effects, of varying directness, upon public health. In some locations, it could disrupt stormwater drainage and sewage disposal. Poverty and the absence of social infrastructure would compound the health consequences of storm damage, disruption of sanitation, and displacement of coastal dwellers. In many places, industrial and agricultural depletion of groundwater already are causing land subsidence, thus decreasing the threshold for impact. Meanwhile, widespread damage to coral reefs is reducing their capacity to buffer shorelines. Rising seas also would cause saltwater to encroach upon freshwater supplies from estuarine and tidal areas. Some changes in the distribution of infectious disease vectors could occur (e.g., *Anopheles sundaicus*, a saltwater vector of malaria).

18.3.5. Climate and Air Pollution: Impacts on Respiratory and Other Health Disorders

The incidence of respiratory disorders—many of which are caused primarily by dusts, noxious gases, allergic reactions, or infections—may be modulated by climate change. Some of these modulatory effects may occur via extreme temperatures or amplification of pollutant levels. Rapid changes in air masses associated with frontal passages may alter the intensity of respiratory illnesses (Ayres, 1990). People with chronic obstructive pulmonary disease (bronchitis and emphysema) often experience exacerbation during winter.

Seasonal allergic disorders would be affected by changes in the production of pollen and other biotic allergens; plant aeroallergens are very sensitive to climate (Emberlin, 1994). Changes in pollen production would principally reflect changes in the natural and agriculturally managed distribution of many plant species—for example, birch trees, grasses, various crops (e.g., oilseed rape, sunflowers), and ragweed species. Hay fever (allergic rhinitis) increases seasonally and may reflect the impact of pollen release. The seasonal distribution and the causation/exacerbation of asthma is more complex. It peaks in the pollen season and increases again later in the year in temperate climates; in the tropics, asthma occurs more frequently in the wet season (LAIA, 1993; *Lancet*, 1985). In many asthmatic individuals, aspects of weather can exacerbate bronchial hyperresponsiveness. For example, the passage of a cold front followed by strong high pressure was found to be associated with unusually high number of asthma admission days in two U.S. cities (Goldstein, 1980). Sandstorms in Kansas (USA) and the Sudan have been accompanied by increases in bronchitis and asthma (Ayres, 1990).

It is well established that exposure to air pollutants, individually and in combinations, has serious public health consequences. For example, exposure to ozone has been shown to exacerbate asthma and impair lung function in children and the elderly (Beckett, 1991; Schwartz, 1994), and both chronic and acute exposures to fine particles are a cause of excess deaths (Dockery *et al.*, 1993; Pope *et al.*, 1995; Schwartz, 1994) even at exposures below prevailing air-quality standards. Since the combustion of fossil fuels is a major source of both carbon dioxide (a major greenhouse gas) and various air pollutants, climate change can be expected to entail more frequent occasions that combine very hot weather with increases in air-pollutant concentrations. In urban environments, the weather conditions that characterize oppressive air masses (see Section 18.2.1) also enhance the concentrations of air pollutants (Seinfeld, 1986); conditions of low wind speed and high humidity occur periodically in which neither heat nor air pollutants are rapidly dispersed. Further, increases in temperature or in ultraviolet irradiation of the lower atmosphere enhance the chemical reactions that produce secondary photochemical oxidant pollutants such as tropospheric ozone (Akimoto *et al.*, 1993; de Leeuw and Leyssius, 1991; Chamiedes *et al.*, 1994).

In many urban settings, studies have shown that daily mortality from cardiovascular and respiratory diseases is a combined function of temperature and air pollutant concentrations. This combination of exposures is also likely to have interactive impacts on health. Indeed, some epidemiological evidence indicates a synergy (a positive interaction) between stressful weather and various air pollutants, especially particulates, upon mortality (e.g., Shumway *et al.*, 1988; Katsouyanni *et al.*, 1993; Shumway and Azari, 1992). The net effect on morbidity/mortality therefore would be greater than anticipated from prior estimates of the separate effects of weather and pollutants.

18.4. Stratospheric Ozone Depletion and Ultraviolet Radiation: Impacts on Health

Stratospheric ozone depletion is a quite distinct process from accumulation of greenhouse gases in the lower atmosphere (troposphere). Depletion of stratospheric ozone has recently occurred in both hemispheres, from polar regions to mid-latitudes (Kerr and McElroy, 1993; see also IPCC Working Group I volume). The major cause of this ongoing depletion is human-made gases, especially the halocarbons (UNEP, 1994).

The problem can be considered alongside climate change for three reasons: (1) several of the greenhouse gases (especially the chlorofluorocarbons) also damage stratospheric ozone; (2) altered temperature in the troposphere may influence stratospheric temperature and chemistry (Rind and Lacis, 1993); and (3) absorption of solar radiation by stratospheric ozone influences the heat budget in the lower atmosphere (see also IPCC Working Group I volume).

Stratospheric ozone absorbs part of the sun's incoming ultraviolet radiation (UVR), including much of the UV-B and all of the highest-energy UV-C. Sustained exposure to UV-B radiation is harmful to humans and many other organisms (UNEP, 1994). It can damage the genetic (DNA) material of living cells and can induce skin cancers in experimental animals. UV-B is implicated in the causation of human skin cancer and lesions of the conjunctiva, cornea, and lens; it may also impair the body's immune system (Jeevan and Kripke, 1993; Armstrong, 1994; UNEP, 1994).

18.4.1. Skin Cancers

Solar radiation has been consistently implicated in the causation of nonmelanocytic and melanocytic skin cancers in fair-skinned humans (IARC, 1992; WHO, 1994b).

Nonmelanocytic skin cancers (NMSCs) comprise basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). The incidence rates, especially of squamous cell carcinoma, correlate with cumulative lifetime exposure to solar radiation (IARC, 1992; Kricker *et al.*, 1995). Studies of the action spectrum (i.e., the relative biological effect of different wavelengths) for skin carcinogenesis in mice indicate that the UV-B band is primarily responsible for NMSC (Tyrrell, 1994). Malignant melanoma arises from the pigment-producing cells (melanocytes) of the skin. Although solar radiation is substantially involved in melanoma causation (IARC, 1992; Armstrong and Kricker, 1993), the relationship is less straightforward than for NMSC; exposure in early life appears to be a major source of increased risk. The marked increases in incidence of melanoma in Western populations over the past two decades (Coleman *et al.*, 1993) probably reflect increases in personal exposure to solar radiation due to changes in patterns of recreation, clothing, and occupation (Armstrong and Kricker, 1994).

The UN Environment Programme predicts that an average 10% loss of ozone (such as occurred at middle-to-high latitudes over the past decade), if sustained globally over several decades, would cause approximately 250,000 additional cases of NMSC worldwide each year (UNEP, 1994). This prediction assumes that a 1% depletion of stratospheric ozone results in a 2.0% (±0.5%) increase in NMSC incidence (80% of which are BCC). Another estimation of this "amplification factor" gives a figure of 2.25% (Slaper *et al.*, 1992; den Elzen, 1994). At higher geographic resolution, Madronich and de Gruijl (1993) predict that persistence of the ozone losses of the 1979–92 period for several decades would cause the incidence of BCC to increase by 1–2% at low latitude (5°), 3–5% at 15–25°, 8–12% at 35–45°, and, at 55–65°, by 13–15% in the northern hemisphere and 20–30% in the south. They estimate that the percentage increases for SCC would be approximately double those for BCC.

18.4.2. Cataracts and Other Damage to the Eye

The external epithelial (keratotic) layer of the eye, comprising cornea and conjunctiva, absorbs virtually all UVR of less than 290 nm wavelength. Corneal photokeratitis, pterygium (a growth of the conjunctival epithelium), and climatic droplet keratopathy are thought to be UVR-related (Taylor *et al.*, 1989; Gray *et al.*, 1992; WHO, 1994b). Inside the eye, the lens absorbs much of the residual UVR, and this absorbed radiation may cause cataracts (Taylor *et al.*, 1988; Dahlback *et al.*, 1989; West *et al.*, 1989; WHO, 1994b).

Cataracts (lens opacities) are independent of skin pigmentation (unlike skin cancer). They occur predominantly in old age and cause more than half of the world's estimated 25–35 million cases of blindness (Harding, 1991). In Western countries, 5–10% of people aged over 65 have cataracts (Klein *et al.*, 1992). The prevalence often is much higher among elderly, malnourished persons in poor countries, where micronutrient deficiencies and the metabolic consequences of severe diarrheal episodes may contribute to cataract formation (Harding, 1992). Scientific debate persists over the extent of the influence of UV-B upon cataract formation (Dolin, 1994; WHO, 1994b); some epidemiological studies have found clear-cut positive results, but others have not. The relationship is most evident for cortical and posterior subcapsular cataracts but less so for the more commonly occurring nuclear cataracts.

Ocular photodamage by UVR is enhanced by certain clinical drugs used in photochemical therapy that can cause photosensitizing reactions (Lerman, 1988). Various other photosensitizing medications would render individuals generally more susceptible to adverse health effects from increased exposure to UVR; these medications include psoralens, thiazides, phenothiazines, barbiturates, allopurinol, and retinoic acid compounds (Lerman, 1986).

18.4.3. Alteration of Immune Function

Human and animal evidence indicates that UV-B irradiation of skin at quite modest levels causes local and, probably, systemic suppression of immunity (Morison, 1989; Noonan and DeFabo, 1990; Jeevan and Kripke, 1993). Most of the evidence is for local immunosuppression, in which the skin's contact hypersensitivity response is impaired (Giannini, 1986; Yoshikawa *et al.*, 1990; UNEP, 1994). UV-B exposure disturbs the function of the skin's Langerhan cells and stimulates the release of certain cytokines (messenger chemicals) that promote the activity of suppressor T lymphocytes, thus dampening the local immune system (UNEP, 1994).

Evidence for more generalized (i.e., systemic) suppression of immunity comes from studies in humans, which show that sunlight exposure increases the suppressor T cells in blood (Hersey *et al.*, 1983). Although there is evidence in humans of UV-induced changes in the profile of circulating immunologically active lymphocytes for several days to weeks, the extent of systemic immune suppression involved remains uncertain (de Gruijl and van der Leun, 1993). Systemic suppression also occurs in UV-irradiated mice (Kripke, 1981; Jeevan and Kripke, 1990).

Immune suppression would alter susceptibility to infectious diseases (Armstrong, 1994). Exposure to UV-B modifies various immunological reactions in mice that influence the pathogenesis of infectious diseases, such as those due to *Herpes simplex* viruses (Otani and Mori, 1987; Yasumoto *et al.*, 1987), leishmania (Gianinni, 1986; Giannini and DeFabo, 1989), candida (Denkins *et al.*, 1989), and mycobacteria (Jeevan and Kripke, 1989). The relevance of these findings for naturally occurring infectious diseases, and for vaccination efficacy, in humans remains unknown. UNEP (1994) concluded that: "It will be very difficult to assess the role of UV-B radiation on natural infections in human populations. Based on current knowledge, we would predict that an effect of UV-B radiation would manifest as an increase in the severity or duration of disease and not necessarily as an increase in disease incidence."

18.4.4. Indirect Effects of Ozone Depletion upon Human Health

An increase in UV-B irradiance is predicted to impair photosynthesis on land and sea (UNEP, 1994). Although the magnitude is uncertain, and may well not be large, there would be at least a marginal reduction in crop yields (Worrest and Grant, 1989) and in the photosynthetic production of biomass by marine phytoplankton, the basis of the aquatic food chain (Smith and Baker, 1989; Smith *et al.*, 1992). Thus, adverse effects of UV-B upon photosynthesis would, to some extent, reduce global food production.

18.5. Options for Adaptation

Various adaptation strategies are possible to reduce the impacts of climate change on human health. Such adaptation could be developed at the population or individual level. The feasibility of adaptation would be constrained for many of the world's populations by a lack of local resources.

At the population level, environmental management of ecosystems (e.g., freshwater resources, wetlands, and agricultural areas sensitive to invasion by vectors), public health surveillance and control programs (especially for infectious diseases), and introduction of protective technologies (e.g., insulated buildings, air conditioning, strengthened sea defences, disaster warning systems) would be important. Improved primary health care for vulnerable populations could play a significant role in reducing a range of health impacts, including some vector-borne and other communicable diseases, and the effects of extreme events. One example is extension of vaccination coverage, although no suitable vaccines exist for some of the diseases most sensitive to climate change (e.g., dengue and schistosomiasis) or for many of the newly emerging infections.

At the individual level, people should be encouraged to refrain from or to limit dangerous exposures (e.g., by use of domestic cooling, protective clothing, mosquito nets). Such behavioral responses could complement any physiological adaptation that might occur spontaneously through acclimatization (to heat stress) or acquired immunity (to infectious diseases).

In view of limitations to the forecasting of health impacts at this stage of our knowledge, an important and practical form of adaptation would be to improve large-scale monitoring and surveillance systems, especially for vulnerable populations and areas. Recently initiated efforts to observe and monitor aspects of the Earth's environment and ecosystems in relation to climate change now should incorporate health-related monitoring (Haines *et al.*, 1993). Advances in climate forecasting and in the regional integration of ecological and health monitoring (including local vulnerability factors) will facilitate development of early-warning systems.

Finally, if health impacts of climate change are probable and serious, then the only effective long-term basis for mitigation lies in primary prevention at the societal level. This would require acceptance of the Precautionary Principle as the foundation of policy response. This, in turn, would suggest some fundamental, and therefore difficult, reorientations of social, economic, and political priorities. Meanwhile, care must be taken that alternative technologies do not introduce new health hazards.

18.6. Research Needs

- Development and validation of integrated mathematical models for the prediction of health impacts. Such models must draw on multiple scientific disciplines and should take maximal account of regional and local influences on the effects being modeled and on their interaction with other environmental stresses.
- Identification and analysis of current or recent settings in which the health impacts of local or regional climate changes (occurring for whatever reason) can be studied. The apparent recent changeable patterns of infectious diseases around the world may afford good opportunities for clarifying and quantifying the influences of climatic factors.
- Incorporation of health-related measurements in global, regional, and local monitoring activities. This would enhance the early detection of shifts in health risks, the evaluation of alternative indices for monitoring health (including the use of sensitive species as bioindicators), and the opportunity to detect and/or examine previously unsuspected or undocumented environment–health relationships.
- Some specific research needs include:
  - Comparison of impacts of heat waves in urban and rural populations, to clarify the relative importance of thermal stress and air pollutants
  - Examination of the interplay between climatic impacts on forests and other terrestrial ecosystems on the range and dynamics of vector-borne disease
  - Study of factors influencing population vulnerability to climate change.

18.7. Concluding Remarks

Forecasting the health impacts of global climate change entails unavoidable uncertainty and complexity. Human populations vary greatly in their vulnerability to climate changes and in their resources for protection and mitigation. Likewise, the responses of infectious disease vectors to changes in climate depend greatly on other concomitant environmental stresses and the adequacy of control measures and health care systems. Meanwhile, population health status continues to be influenced by a rich mix of cultural and socioeconomic factors. Hence, assessing the health impact of climate change requires a systems-based modeling approach that integrates information about climatic factors, other environmental stresses, ecological processes, and social-economic-political inputs and responses.

Alongside the need for improved health impact assessment capability is a precautionary need to develop global, regional, and local monitoring systems for the early detection of climate-induced changes in human health. There have, indeed, been various recent events that, plausibly, might be early signals of such change. The increased heat-related deaths in India in 1995; the changes in geographic range of some vector-borne diseases; the coastal spread of cholera: Could these be early indications of shifts in population health risk in response to aspects of climate change? Of course, it is not possible to attribute particular, isolated events to a change in climate or weather pattern; other plausible explanations exist for each of them, and a number of different factors may combine to produce each event. However, it is important that we begin to assess patterns of change in the various indices of human health that will provide early insight and will assist further the development of predictive modeling.

There is thus a clear need for enhanced research and monitoring activities. This need reflects the assessment that the potential health impacts of climate change, particularly if sustained in the longer term and if generally adverse, could be a serious consequence of the ongoing anthropogenic changes in the composition of Earth's atmosphere.

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Q2. I note that the November 7, 1997, edition of *Science* contains an article by Gary Taube, entitled "Apocalypse Not," which has the following subtitle:

> **"Predictions that global warming will spark epidemics have little basis, say infectious-disease specialists, who argue that public health measures will inevitably outweigh effects of climate."**

The article concludes with a quote by virologist Barry Beaty of Colorado State University in Fort Collins:

> **" 'You don't have to be a rocket scientist to say we've got a problem,' he says. 'But global warming is not the current problem. It is a collapse in public health measures, an increase in drug resistance in parasites, and an increase in pesticide resistance in vector populations. Mosquitoes and parasites are efficiently exploiting these problems.' "**

Q2.1 What is the Administration doing to address these obvious serious public health measures?

A2.1 The Administration is addressing the critical public health concerns mentioned by Dr. Beaty, including parasite drug resistance and insect pesticide resistance, through strong support of research on these issues and through support of the U.S. public health system. The world's public health infrastructure has been and will continue to be of critical importance for minimizing environment-related health problems. The prevailing scientific consensus is that climate change will impose an additional stress on the public health care system, with possible adverse consequences especially where infrastructure is already overburdened.

Q2.2 Why does the Protocol and the Administration not put more emphasis on such measures?

A2.2 The Protocol does not put more emphasis on controlling resistance in parasites and insects because the issue of resistance appears to be scientifically distinct from climate change. Resistance problems would be occurring even if the climate were not changing at all. Scientific studies have shown that with climate change, specifically the rise in temperatures, the geographic area of survivability of parasites and insects is being extended. Please see A2.1 above regarding the Administration's public health measures.

Q2.3 Please also provide more details about efforts mentioned in the article to try to resolve disputes over these issues, including studies and other efforts by the Centers for Disease Control and Prevention, National Research Council and NASA. Also, please identify all the persons involved in the Administration's efforts, including their expertise and a description of their mission and timetable.

A2.3 There are a number of efforts underway to examine the potential health effects of climate change, including work at the government agencies you mention. Examination of health effects of climate change has also been an ongoing effort within the context of the US Global Change Research Program. For more specific descriptions of projects and timetables, we respectfully suggest you contact the individual agencies that sponsor these research efforts.

Is the Kyoto Protocol Target the United States Agreed to Actually 7% Lower than What the President Proposed in October?

Q3. On page 3 of your prepared testimony you stated that "When changes in the accounting rules for certain gases and offsets for activities that absorb carbon dioxide are factored in, the level of effort required of the United States is quite close to the President's original proposal to return emissions to 1990 levels by 2008-2012, representing at most a 3 percent real reduction below that proposal, and perhaps less."

In addition, the January 15, 1998 "Fact Sheet" on the Kyoto Protocol released by the Department of State's Bureau of Oceans and International Environmental and Scientific Affairs contained the following:

> ***"Is the target the United States agreed to actually 7% lower than what the President proposed in October?***
>
> **"No. The 7% target represents at most a 3% real reduction below the President's initial proposal of reducing greenhouse gases to 1990 levels by 2008-2012. The remaining 4 percentage points result from certain changes in the way gases and sinks are calculated and do not reflect any increase in effort as compared to the President's original proposal.**
>
> **"Changing the baseline for the three synthetic greenhouse gasses from 1990 to 1995 accounts for about 1% of the 7% reduction. Use of these three gases has grown since 1990, so that permitting a 1995 baseline allows for a higher overall baseline than the Administration assumed last October when the President announced his goal of reaching 1990 levels by 2008-2012. Making reductions to meet a higher baseline is of course easier than making reductions to meet a lower baseline. Had**

> **the United States maintained the same level of effort assumed by the President in October, and no other factors had changed, the shift to a 1995 baseline for the three synthetic gases would, alone, have transformed the President's goal of 1990 levels into a goal equivalent to 1% below 1990 levels.**
>
> **"Altering the accounting method for carbon-absorbing activities, such as planting trees, accounts for about 3% of the 7% reduction. The President's original goal assumed that the 1990 baseline would be lowered by carbon-absorbing activities, but under the method agreed in Kyoto, such activities do not lower the 1990 baseline. Because the 1990 level baseline is thus higher under the Kyoto agreement, the U.S. target becomes somewhat less stringent. Specifically, had the U.S. maintained the same level of effort assumed by the President in October, and no other factors had changed, the shift in the accounting method for carbon-absorbing activities would, alone, have transformed the President's goal of 1990 levels into a goal equivalent to at least 3% below 1990 levels. (As noted above, certain carbon-absorbing activities will count against emission reduction commitments in the budget period.)"**

Please provide a detailed listing of all assumptions and a detailed set of calculations that verify both the above quoted statement in your written testimony and the above quoted passage contained in the January 15, 1998, "Fact Sheet."

A3. The President's October 1997 proposal to return greenhouse gas emissions to 1990 levels by 2008-2012 differs in several important respects from the Kyoto Protocol goal for reducing greenhouse gas emissions.

First, the President's October proposal was based on the target for all gases using 1990 emission levels as a baseline. The Kyoto Protocol permits countries to use 1995 levels for three synthetic greenhouse gases. In the case of the United States, 1995 levels for these gases, were as reported in our national communication, about 12.6 million metric tonnes of carbon equivalent higher than 1990 levels, or about 1% of our overall commitment.

Second, the President's October proposal was based on a "net-net" approach for sinks, where the carbon sequestration activities of sinks was subtracted from the 1990 emission level in computing the target; however, the Kyoto Protocol does not require countries to subtract carbon sequestration activities occurring in 1990 in determining their emissions targets. For the United States, this change provides a larger target amount of about 55 million metric tonnes of carbon equivalent, or just over 3% of our overall commitment.

Taken together, the two accounting differences resulted in the emissions target being about 68 million metric tonnes of carbon equivalent less stringent than it would be under the accounting system included in the President's October proposal. 68 million tons is about 4 percentage points of the target amount.

Significance of U.S. Signing the Kyoto Protocol

Q4. During the hearing you stated that the U.S. signing of the Kyoto Protocol will not legally bind us to any of its provisions.

Q4.1 Could the signing of the Protocol sometime over the next year and before the Administration obtains such "meaningful participation of key developing countries" possibly mislead them and other countries into believing that the U.S. will ultimately ratify the Protocol, notwithstanding the provisions of the Byrd-Hagel Resolution (S. Res. 98)?

A4.1 No one could be misled about the U.S. position. At Kyoto, the U.S. Delegation made clear to other delegations the importance the United States attaches to developing country participation, referring frequently to the Byrd-Hagel resolution. Subsequently, in numerous bilateral opportunities, and at the G-8 Summit in Birmingham in May 1998, we reiterated the importance of meaningful participation by developing countries to U.S. ratification. All parties to the negotiations are well aware of the U.S. position on this issue. Signing the Protocol would in no way preclude us from seeking modifications to add developing country commitments. The Protocol is designed to be consistent with the Convention, whose objective is to reduce greenhouse emissions generally. Adding developing country commitments is fully consistent with this objective.

Q4.2 What signals would you be trying to convey to these countries by signing the Protocol?

A4.2 It is important that developing countries understand that we take the threat of global warming seriously and are prepared to join with others in pursuit of a global solution. By not signing the Protocol, the United States could give developing countries reason to question whether in fact this is a problem that deserves their attention and whether the United States is committed to a global solution.

Q5. On March 16, 1998, the Secretariat of the UN Framework Convention on Climate Change issued a press release entitled, "Kyoto Protocol on climate change opens for signature," which stated the following: "By signing a treaty a State indicates that it recognizes the authentic text, intends to complete the procedures for becoming legally bound by it, and is committed not to act against the treaty's objectives before being so bound."

Does the U.S. agree with this interpretation of the meaning of "Signature"?

A5. The State Department accepts Article 18 of the Vienna Convention on the Law of Treaties as expressing customary international law on this issue. That Article provides that a State is obliged to refrain from acts which would defeat the object and purpose of a treaty when: (a) it has signed the treaty or has exchanged instruments constituting the treaty subject to ratification, acceptance or approval, until it shall have made its intentions clear not to become a party to the treaty; or (b) it has expressed its consent to be bound to the treaty, pending entry into force of the treaty and provided that such entry into force is not unduly delayed. The Vienna Convention is the appropriate legal standard.

Developing Country Participation: The Bonn and Buenos Aires Agendas and Processes for Addressing Developing Country Participation

Q6. A number of the decisions adopted by the Conference of the Parties to the U.N. Framework Convention on Climate Change (COP) at its Third Session (COP-3) in Kyoto relate to topics to be addressed by the COP Subsidiary Bodies in Bonn in June and by the COP at its Fourth Session (COP-4) in Buenos Aires. However, it does not appear that any of the decisions address the issue of further developing country participation in the Kyoto Protocol.

Q6.1 Do the tentative agendas for Bonn and Buenos Aires include a process of any kind for addressing this developing country participation issue?

A6.1 Yes, the issue of developing country participation arose in Bonn in June 1998 in several ways: (1) in the discussion of the second review of the adequacy of Article 4.2(a) and (b) of the Convention; (2) in the discussion of the agenda for COP-4, in particular item 6 on Voluntary Commitments by Parties not included in Annex I; and (3) in the discussion of the Brazilian proposal (that would gauge "responsibility" for climate change based on each country's contribution to the increase in global average temperature. We anticipate that these same issues will also be discussed in Buenos Aires.

Q6.2 If not, will the U.S. and other Annex I countries seek to include it on these agendas?

A6.2 As stated in our response to Q.6.1 above, the issue of developing country participation will arise in several ways at COP-4 in Buenos Aires pursuant to items that have been included on the draft agenda for that session.

Q6.3 In the absence of such an agenda item, when and how will negotiations for such participation begin?

A6.3 Notwithstanding the inclusion of several agenda items that bear on the issue of developing country participation, the outcome of the discussions in Buenos Aires is not certain. Many developing countries strongly oppose efforts to take up the issue of further commitments for them unless and until developed countries begin taking action to meet the targets they have set for themselves. Increasingly, however, developing countries seem to acknowledge that achieving a global solution to the problem of global warming will ultimately involve further commitments from them — but significant questions remain as to when such commitments would begin, to whom they would apply, what kind of commitments they would be, what kind of assistance developing countries would need to support their efforts, and what actions developed countries would take in conjunction with further commitments from developing countries. These are difficult issues that will continue to be the focus of discussion for some time to come.

Q6.4 Are you suggesting a process outside of the COP process, such as bilateral country-by-country process?

A6.4 Obtaining meaningful participation of key developing countries in global efforts to combat climate change has been and will continue to be an ongoing priority of U.S. diplomacy both within and outside the COP process. Senior officials in the State Department and other agencies, as well as the President and Vice President, have held numerous conversations in bilateral and multilateral venues to explore how undertaking binding limits on greenhouse gas emissions could meet both developmental and environmental objectives. These conversations have occurred with most Parties to the Convention, including both developed and developing countries, and generally have yielded a productive exchange of views. We will continue such conversations and actively seek both support and mechanisms for progress.

Q6.5 What is the major diplomatic effort you plan and when will it start?

A6.5 See above answer to Question 6.4.

Developing Country Participation: Use of Article 41 of the Vienna Convention on the Law of Treaties to Obtain Developing Country Participation

Q7. Article 41 of the Vienna Convention on the Law of Treaties provides for agreements to modify multilateral treaties between certain parties only as follows:

> **"1. Two or more of the parties to a multilateral treaty may conclude an agreement to modify the treaty as between themselves only if:**
>
> > **(a) The possibility of such a modification is provided for by the treaty; or**
> >
> > **(b) the modification in question is not prohibited for by the treaty and:**
> >
> > > **(i) does not affect the enjoyment by the other parties of their rights under the treaty or the performance of their obligations;**
> > >
> > > **(ii) Does not relate to a provision, derogation from which is incompatible with the effective execution of the object and purpose of the treaty as a whole.**

2. Unless in a case falling under paragraph 1(a) the treaty otherwise provides, the parties in question shall notify the other parties of their intention to conclude the agreement and of the modification to the treaty for which it provides."

Q7.1 It is my understanding that the Kyoto Protocol neither provides the possibility of such a modification nor prohibits such a modification, so that Article 41 procedures could apply. Do you agree and if not, why not?

A7.1 Article 41, which refers to actions by parties to multilateral treaties would, strictly speaking, apply to the Kyoto Protocol only after it enters into force.

Q7.2 Does the Administration intend to use the Article 41 procedures to entice key developing country participation in some matter under the Protocol to seek compliance with the provisions of the Byrd-Hagel Resolution (S. Res. 98)?

A7.2 The Administration has not determined the precise manner in which the meaningful participation of key developing countries is to be reflected.

Q7.3 Would any such agreements using Article 41 procedures to modify multilateral treaties between certain parties have to be submitted to the Senate for its advice and consent to ratification, and if not, why not?

A7.3 Assuming such an agreement included the United States, it is likely that it would be submitted to the Senate for advice and consent to ratification. We cannot answer in the abstract whether all modifications to multilateral agreements in force must in all cases be submitted to the Senate for advice and consent to ratification.

Developing Country Participation: Possibility of New and Additional U.S. Commitments or Requirements to Obtain Developing Country Participation

Q8. In seeking a new amendment or a supplemental protocol, what assurances do we have that the developing countries will not insist, as a *quid pro quo*, on new and additional commitments or requirements, including financial and post-2012 commitments, by the Annex I Parties to the FCCC that the U.S. would have to accept, even with modifications, to achieve such participation by developing countries?

A8. There can be no assurances as to what the developing countries may seek as a *quid pro quo* for their participation. This will be the subject of future negotiations.

Developing Country Participation: Developing Country Participation in Emissions Trading through an Amendment to Annex B of the Protocol

Q9. The January 15, 1998 "Fact Sheet" on the Kyoto Protocol released by the Department of State's Bureau of Oceans and International Environmental and Scientific Affairs, states that "Developing countries may, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets."

Q9.1 Please explain how and when an amendment to Annex B (which currently applies to Annex I Parties) can be accomplished and how it would enable developing countries to participate in trading.

A9.1 In order to engage in emissions trading under Article 17, a State would need to join Annex I under the Convention (which, under Article 4.2(g) of the Convention, requires notification to the Depositary but does not require the approval of other Parties) and propose an amendment to Annex B to reflect its quantitative commitment. If the Protocol had not yet entered into force (in which case an amendment would not yet be possible), the Conference of the Parties could reflect any new quantitative commitment in a modifying agreement that was linked, substantively and in terms of entry into force, to the Kyoto Protocol.

Q9.2 Would such countries also be subject to all of the Articles of the Protocol?

A9.2 Yes, including those applying only to Annex I Parties.

Q9.3 Since developing countries can already "sell" an unlimited supply of emissions credits under the Clean Development Mechanism, why would they accept an emissions target so they could "trade" a limited supply of credits?

A9.3 Under the Clean Development Mechanism, a developing country may sell credits only for certified emissions reductions resulting from certified projects carried out according to Article 12 of the Protocol, presuming that the project agreement does not place restrictions on the use of those credits. If that same country were to be listed in Annex B, it would be eligible to freely trade allowances based on its agreed cap. The latter could very well be more advantageous, depending on where the cap is set and what opportunities exist in its economy to reduce emissions.

Impacts of Delaying Submission of the Kyoto Protocol to the Senate for Its Advice and Consent to Ratification on Ability of the U.S. to Meet Protocol Requirements

Q10. During the hearing you said that the Administration "won't even submit" the Kyoto Protocol to the Senate for its advice and consent to ratification until developing country participation is obtained.

Q10.1 Is it the intention of the Administration to defer for the remainder of the President's term, if necessary, submittal of the U.S. to the Senate so long as such participation of the key developing countries you have mentioned in your testimony is not achieved by Protocol amendment or supplemental Protocol, notwithstanding that delaying such submittal for Senate consideration eats into the Protocol's lead time prior to the Article 3.2 requirement that the U.S. is "to have made demonstrable progress in achieving its commitments" by 2005 and the commitment period of 2008-2012?

A10.1 The Administration has not taken a position on the timing of submission of the Protocol to the Senate for its advice and consent. President Clinton has said he will not submit the Protocol to the Senate without meaningful participation of key developing countries.

Q10.2 What signal does that policy send to other nations and to the U.S. economy?

A10.2 The signal it sends is that the United States will not ratify the Protocol without meaningful participation of key developing countries.

Q10.3 In short, how long will you pursue such participation before deciding to submit the Protocol to the Senate?

A10.3 See answer to Question 10.1.

Administration's Commitment to Submitting to the Senate for Ratification Any Amendment and/or Supplemental Protocol to the Kyoto Protocol

Q11. Is the Administration committed to submitting to the Senate for advice and consent to ratification any amendment to the Protocol or supplemental protocol regarding such participation by developing countries?

A11. Yes. Any such amendment to the Protocol or supplemental protocol would be submitted to the Senate for advice and consent to ratification.

Q11.1 If the answer to Q11 is yes, would it be submitted at the same time as the original Protocol?

A11.1 That would depend on the timing of the adoption of the amendment or supplemental protocol.

Q11.2 If the answer to Q11 is no, please explain why not, given the provisions of S. Res. 98.

Q11.3 If not, please explain why not, given the provisions of S. Res. 98.

Must Any Amendments to the Protocol Be Submitted to the Senate for Advise and Consent to Ratification?

Q12. In response to questions by Representative Rivers, you said that the Protocol Parties will, under Article 20, try to decide on amendments by consensus, but if that fails, that could be accomplished by a 3/4ths vote. You also said any amendment to the Protocol, once adopted, "would not bind a Party until it ratifies an amendment."

Does the Administration agree that any amendments to the Protocol must be submitted to the Senate for advise and consent to ratification?

A12. No. The Protocol contains two original Annexes, A (on greenhouse gases) and B (on quantitative commitments). Pursuant to Article 21, amendments to these original Annexes would be treated as non-technical and would therefore fall under the Article 20 amendment procedure. Amendments to future Annexes, however (which, by virtue of Article 21.1, would be restricted to "lists, forms and any other material of a descriptive nature that is of a scientific, technical, procedural or administrative character"), would be subject to an opt-out procedure under Article 21.

Is the Adoption of an Amendment by "the Conference of the Parties Serving as the Meeting of the Parties" a Decision of "the Conference of the Parties Serving as the Meeting of the Parties"?

Q13. It appears that under the Kyoto Protocol most rules, guidelines, procedures, modalities, etc., for joint implementation, sinks, clean development mechanism, and other measures are to be developed by the "Conference of the Parties serving as the meeting of the Parties to this Protocol" at its first session after entry-into-force "or as soon as practicable thereafter."

Article 13.1 states: "The Conference of the Parties, the supreme body of the Convention, shall serve as the meeting of the Parties to this Protocol."

And, Article 13.2 states: "Parties to the Convention that are not Parties to this Protocol may participate as observers in the proceedings of any session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. When the Conference of the Parties serves as the meeting of the Parties to this Protocol, decisions under this Protocol shall be taken only by those that are Parties to this Protocol."

Is the adoption of an amendment by "The Conference of the Parties Serving as the Meeting of the Parties" *always* defined to be a decision of "the Conference of the Parties Serving as the Meeting of the Parties"? In other words, *could there ever be* a circumstance when the adoption of an amendment to the Protocol by "the Conference of the Parties Serving as the Meeting of the Parties" *could not* be considered a decision under the Protocol so that the amendment would apply to

Parties to the U.N. Framework Convention on Climate Change who are not Parties to the Kyoto Protocol?

A.13 We know of no circumstance consistent with the terms of the Kyoto Protocol whereby an amendment to the Protocol could be made to apply to Parties to the Convention which are not Parties to the Protocol. An amendment must be handled in accordance with Article 20 of the Protocol.

Article 17 Provision for the Conference of the Parties to Define the Principles, Modalities, Rules and Guidelines for Emissions Trading

Q14. As noted in Question 13 above, "The Conference of the Parties serving as the meeting of the Parties to this Protocol" is to develop most the most Protocol's rules, guidelines, procedures, modalities, etc., for joint implementation, sinks, clean development mechanism, and other measures. However, Article 17 provides that the Conference of the Parties, *not* the Parties to the Protocol, must "define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading."

Q14.1 Why did you agree to this different approach for emissions trading?

A14.1 The penultimate draft of the Kyoto Protocol included text that spelled out some rules under which emissions trading would operate. However, in the press of the negotiations, the text was dropped – notwithstanding the fact that most countries supported many of the concepts embedded in that text. In order to allow rapid progress on resolving the emissions trading issues, and to express its view that the rules should be completed expeditiously (even prior to entry into force of the Protocol), it was decided to allow the Conference of the Parties (COP) rather than the COP/mop (Conference of the Parties/Meeting of the Parties) to develop any such rules.

Q14.2 Is it your understanding that the Bonn meeting and COP-4 will try to adopt by decision all these types of rules by consensus, and if not, what is your understanding of the plan?

A14.2 Currently, rules of procedure for the FCCC have not been adopted. In their absence, all decisions of the COP are being taken by consensus. Decisions on emissions trading at Bonn were taken by consensus, and we anticipate this to be true also for Buenos Aires and COP-4.

Q14.3 Will all such rules, etc., including those on emissions trading also be subject to adoption by the Protocol Parties after entry-into-force and could those Parties change them prior to such adoption, or are those adopted by the Conference of the Parties for emissions trading merely to be accepted by the Protocol Parties without any further action?

A14.3 Emissions trading rules under Article 17 are to be decided by the Conference of the Parties, rather than the Conference of the Parties serving as the meeting of the Parties to the Protocol (COP/moP). As to other sets of rules, these could theoretically be subject to change prior to adoption by the COP/moP; however, this is unlikely, given that the States represented in the COP/moP will be a subset of those represented in the COP.

Q14.4 Are all such decisions subject to the provisions of either Articles 19 or 20 of the Protocol?

A14.4 No. (It is assumed that the question intended to refer to Articles 20 and 21.)

Article 17 and the Possible Role of the United Nations Relative to U.S. Economic Growth and Foreign Policy

Q15. Representative Rivers raised the issue of the possible role of the United Nations relative to U.S. economic growth and foreign policy, and you said that "We determine the rules for trading." That seems inconsistent with my understanding of Article 17 which, as noted above in Question 14, provides that "The Conference of the Parties shall define the relevant principles, modalities, rules, and guidelines, in particular for verification, reporting and accountability for emissions trading." That mandate appears to authorize and direct the Conference of the Parties to perform that function and could include the involvement of the Secretariat or another international body.

Do you agree, and if not, please explain why?

A15. As stated in Article 17 of the Protocol: "The Conference of the Parties shall define relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading." The Parties, not the United Nations, thus have authority to determine the rules for trading.

Article 17 Requirement That Emissions Trading Be Supplemental to Domestic Actions

Q16. Article 17 also provides that "Any such [emissions] trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article [i.e., Article 3]."

On Thursday, December 11, 1997, *Agence France-Presse*, in an article entitled, "Germany sets conditions for signing Kyoto climate accord," reported the following:

> **"Germany Environment Minister Angela Merkel said in a communique: 'Germany will not sign the protocol until the rules of the marketplace have been set.' "**

> **" 'It is not acceptable that industrialized countries meet their pledges to reduce emissions strictly by trade' in polluting permits, Merkel said.**
>
> **"She said 'at least 50 percent of pledges must be met by national measures.' "**

And the Tuesday, March 24, 1998, edition of the *BNA Daily Report for Executives*, in an article entitled "European Ministers to Press U.S. On Domestic Greenhouse Reductions" on page 26, stated the following:

> **"European ministers agreed March 23 to a tentative text that would serve as part of the EU's negotiating position of the next meeting of the parties to the climate change convention. It states that 'domestic action should provide the main means of meeting the commitment under Article 3 of the Kyoto Protocol and that the modalities, rules and guidelines for the operation of flexible mechanisms should ensure that those mechanisms do not undermine this principle or weaken the commitments under Article 3.'**
>
> **"The ministers also agreed that 'in this context a concrete ceiling on the use of flexible mechanisms has to be defined to achieve these aims.'**
>
> **"European Commissioner Ritt Bjerregaard stated that the EU 'fears the United States will not live up to its Kyoto Protocol commitments' to reduce greenhouse gases.**
>
> **" 'As it is the leading emitter of greenhouse gases, the United States needs to take tough domestic measures,' said Commission Spokesman Peter Jorgenson. 'We believe that it is going to try and buy its way out of its Kyoto commitments and we are determined to prevent that from happening.' "**

We understand that in your response to a question posed by Subcommittee on Energy and Power Chairman Schaefer on prior House testimony you said that "we would not accept such a limitation. Period."

Q16.1 Please explain the purpose and meaning of the reference to "domestic actions," taking into consideration the above comments.

A16.1 The Administration anticipates that, in meeting the Kyoto Protocol targets, countries will rely on both domestic action and international emissions trading under the Protocol's market-based mechanisms. As the language in Article 17 referring to "domestic actions" is merely a recognition of this fact and the term "supplemental" is not quantified, it was acceptable.

Q16.2 Is this phrase in Article 17 a potential "artificial restraint" on such trading?"

A16.2 We do not believe that the text of Article 17 imposes constraints on emissions trading.

Legal Status of Kyoto Protocol Rules, Guidelines, Procedures, Modalities, Etc., Adopted by the Conference of the Parties and/or the Parties to the Protocol

Q17. Once adopted by the Conference of the Parties and/or the Parties to the Protocol, are the rules, guidelines, procedures, modalities, etc., referred to in Questions 13 and 14 above legally binding obligations of the United States, or are they first required to be submitted to the Senate for advice and consent to ratification?

Q17.1 If they are not legally binding, what is their status and how can they be changed?

A17.1 Such rules, guidelines, etc. would not be subject to ratification by Parties. The rules, etc. would not constitute legally binding obligations in the same sense as Article 3 (the target commitment), because there is no obligation to engage in emissions trading. At the same time, we would consider that, if a Party were to elect to engage in emissions trading, it would have implicitly agreed to abide by the rules, etc., with whatever consequences the rules spelled out for not complying with them (such as, for example, losing the ability to trade).

Q17.2 How would the U.S. treat them?

A17.2 See response to Q17.1.

U.S. Conceptual Agreement With a Number of Countries to Pursue an Umbrella Group to Trade Emissions Permits

Q18. The January 15, 1998 "Fact Sheet" on the Kyoto Protocol released by the Department of State's Bureau of Oceans and International Environmental and Scientific Affairs states that the "United States also reached a conceptual agreement with a number of countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to pursue an umbrella group to trade emissions permits."

Q18.1 When was that agreement reached and what are its details?

A18.1 The agreement on the umbrella was reached in informal consultations with countries, both collectively and individually over the course of the ministerial portion of the Conference of the parties in Kyoto. At the time it was reached, the group was envisioned as a potential counterweight to the European Union, which during the Kyoto meetings was opposing free and open emissions trading. Since that time, a number of ideas have gained currency within the group as to how an emissions trading regime might be structured – these were embodied in a paper circulated at the most recent session of the FCCC Subsidiary Bodies in Bonn (paper is attached). Since Bonn, the group has been working to further refine its emissions trading ideas, and has also turned its attention to the other market mechanisms (joint implementation and the Clean Development Mechanism).

Q18.2 What are this "umbrella" group's relationships to the Protocol and Articles 3, 6, and 17?

A18.2 As noted in the response to 18.1 above, the group has outlined its concept of its role in a paper circulated in Bonn. This Umbrella Group paper primarily focuses on Article 17, and indirectly, on Article 3. Although not the main objective of the group is currently examining aspects of both the joint implementation and Clean Development Mechanism issue.

Q18.3 Did the U.S. reach any other agreements or understandings at Kyoto or thereafter with one or more countries that have not yet been reported?

A18.3 No formal "agreements" or "understandings" were reached in or since Kyoto that relate to emissions trading. To date, the umbrella group has focused on developing options for operational rules and guidelines that any country might adopt and use as part of an open international trading system. Unless other countries called for limiting or restricting the right of Umbrella Group Parties to trade, we would propose to continue this open and inclusive effort.

Administration Plans to Implement the Kyoto Protocol Without Senate Ratification

Q19. On March 10, 1998, Patrice Hill of *The Washington Times* reported on a "predecisional" Environmental Protection Agency (EPA) document that "asserts that EPA could use its authority under the Clean Air Act to force power plants to curb their emissions of carbon dioxide, the principal gas said to be warming the earth's atmosphere." In the same article, *The Washington Times* also reported that an administration source said that "the Department of Justice is proposing to expand the Community Right to Know law to require plants that emit carbon dioxide to notify surrounding communities of the potential environmental hazard." The source also said that "Carbon dioxide is regarded more and more as a regular

pollutant within the administration, though it is one of the most common atmospheric gasses emitted by humans, animals, and machines."

I also understand that EPA proposed a rule on February 3, 1998, under Section 612 of the amended Clean Air Act of 1990, banning self-chilling cans using HFC-134a or HFC-152a—not as protection of the ozone layer, but to control one of the six greenhouse gases referenced in the Kyoto Protocol.

How are these Administration actions consistent with your assurances to Representative English and to the rest of the Committee, presumably on behalf of the Administration, that "in terms of binding obligations, we do not intend to in any way, shape, or form, through the back door, the front door, the side door, or any other efforts, to bind this country, or any other sectors of this country, until the Senate has acted in a constitutional manner"?

A19. The first part of your question describes a "pre-decisional" Environmental Protection Agency (EPA) memorandum. We know that EPA legal counsel drafted a legal opinion for EPA Administrator Browner in response to a March 11, 1998 request from Congressman DeLay regarding, et alia, the extent of the EPA's ability to determine what airborne chemicals are pollutants and thus can be regulated under the Clean Air Act.

Also in Question 19's first paragraph, mention is made of Department of Justice (DOJ) activities. I know that in the fall of 1997 — before the Kyoto Protocol was negotiated in December — a DOJ memorandum proposed to an interagency policy group that the Administration consider expanding the community right-to-know framework to producers of greenhouse gas emissions. The proposal was made during the general consideration of Administration policies and positions prior to the President's October 1997 climate speech. As far as I can recall, this proposal was not discussed within the interagency group or further elaborated upon. It was not considered in developing positions for Kyoto or in the Protocol itself.

Focusing on the last two paragraphs of your question, I am aware that in March 1998 the EPA issued a notice of proposed rule-making on the issue of "self-chilling" cans that were conceived to be activated by vented HFC-134a and HFC-152a, hydrofluorocarbons. It is my understanding that these substances, replacements for CFC refrigerants, are only approved in closed systems and that EPA regulations have long required the recovery and reuse of both CFC-substitute refrigerants.

Administration's Bases for Declaring Carbon Dioxide and Other Greenhouse Gases to be Pollutants

Q20. It is my understanding that carbon dioxide, water vapor, methane, and other gases, known collectively as greenhouse gases, help maintain the Earth's temperature, which is critical to the maintenance of human, animal and plant life as we know it; that some greenhouse gases are produced continuously by humans; that greenhouse gases, such as carbon dioxide and water vapor are critical to the well-being of most plants; and that within the meaning of the Clean Air Act, individuals are not greenhouse gas polluters.

Q20.1 Is my understanding as stated above correct, and if not, what is the correct information?

A20.1 Your statements are correct.

Q20.2 What, then, is the Administration's basis for declaring carbon dioxide a "pollutant" for purposes of regulatory actions within the meaning of the Clean Air Act, such as those just referenced above in Question 19?

A20.2 It is my understanding that EPA has developed an analysis of its legal authority under the Clean Air Act to regulate carbon dioxide as a pollutant emitted by electric power generation sources. We understand that EPA's legal opinion has already been provided to your committee. I would refer you to their responses to your questions. The Department of State is not a regulatory agency and does not have authority to regulate pollutants.

Q20.3 Are you trying to suggest that there is "good" carbon dioxide and "bad" carbon dioxide?

A20.3 No. Carbon dioxide is an essential component of our atmosphere. The problem with carbon dioxide is that its concentration in our atmosphere is rising at an alarming rate, already reaching concentrations much higher than the window of natural variability over at least the last 160,000 years. By the year 2100, if we continue along our same trajectory, the concentrations are predicted to be above 700 parts per million, higher than any level for at least the past 50 million years.

Q20.4 Would you reach the same conclusion for water vapor, the most dominant greenhouse gas?

A20.4 While water vapor is the most abundant natural greenhouse gas, its atmospheric concentration is controlled primarily by natural processes that add or remove water to sustain a near steady-state amount consistent with the existing temperature and atmospheric circulation patterns. These in turn are strongly influenced by the atmospheric water vapor concentration. The adjustment time for water vapor tends to be a few weeks and the amount in the atmosphere is very large, which is why human-induced additions of water to the atmosphere make little difference except very locally.

Water vapor will, however, play an important role in exacerbating human-induced warming through a feedback on by higher temperatures in the lower atmosphere. Specifically, the warming influence of carbon dioxide, methane, nitrous oxide, chlorofluorocarbons (CFCs), and some other greenhouse gases in the lower atmosphere allow a response in the water vapor concentration through natural processes. And because this adjustment is so fast and because water vapor is such an important greenhouse gas, further warming occurs: this furthers warming until a new steady state is established. This natural amplification effect is referred to as water vapor feedback, and it is estimated to cause the ultimate warming to be a few times larger than would be caused by the greenhouse gas increase alone.

Opportunity for Congressional and Public Review of U.S. Positions for Upcoming Bonn and Buenos Aires Meetings

Q21. In January and June 1997, the State Department released to the public drafts of a proposed protocol that was submitted to the Ad-Hoc Group on the Berlin Mandate (AGBM). However, there was no prior opportunity for Congressional and public review and comment on those drafts.

Q21.1 Does the Administration plan to develop and propose in Bonn and/or Buenos Aires text for the rules, guidelines, etc., mentioned in Questions 13 and 14 above?

A21.1 We did not develop and propose text for the June meetings in Bonn. Plans for Buenos Aires are still being finalized, and we have not made ultimate decisions on specific proposals for text for rules and guidelines on emissions trading, joint implementation, the Clean Development Mechanism, or sinks.

Q21.2 Given your comments about "working closely with industry" and the potential importance of such rules, etc., to our domestic economy, will the Administration allow at least 30 days for review and comment by Congress and the public prior to any such submittal, and if not, why not?

A21.2 Prior to Kyoto, the Administration developed its position in consultation with Congress and the public. We anticipate following the same process for Buenos Aires. Currently, the Administration is developing positions on a number of issues with other countries, and has conducted informal discussions with experts outside the Administration and other interested parties, including a wide variety of industry groups and NGOs. We have also received advice and guidance from Members of Congress through a variety of hearings, meetings, briefings and correspondence.

Q21.3 If your answer to Q21.2 is no, please explain how you will be "working closely with industry," and does the term "industry" include labor and agriculture?

A21.3 See response to Q21.2. The Administration's policy is to involve the full range of interests in its discussions on climate change policy, including utilities, manufacturing, labor, agriculture, environmental, state and local groups. We are also conducting consultations with major industrial sectors interested in taking voluntary action to reduce emissions.

New U.S. Requirements Imposed by Articles 10 and 11 of the Kyoto Protocol

Q22. I understand that Articles 10 and 11 of the Protocol relate to existing commitments under Article 4.1 of the U.N. Framework Convention on Climate Change and apply to all Parties to the Convention. And in the U.S. 1996 Non-Paper, it was stressed that "next steps under the Convention must include all Parties."

Q22.1 Do I understand correctly that implementation of the provisions of Articles 10 and 11 by all Parties depends on "all Parties," becoming Parties to the Protocol?

A.22.1 Yes, only Parties to the Protocol would be bound by its provisions.

Q22.2 Please explain what new requirements these Articles would impose on the U.S. and what, if any, new funds and legislation would be needed to implement them.

A22.2 Strictly speaking, Article 10 advances existing commitments, rather than creating new requirements.

Article 11 restates existing obligations under the Framework Convention.

Although we have not conducted an article-by-article analysis of the need for new legislation, it is unlikely that any will be necessary regarding these Articles.

Regarding funding, for the most part, the United States and other developed country Parties to the Convention meet their requirements to provide such financial assistance through their annual contributions to the Global Environment Facility and through their bilateral assistance efforts, such as the programs of the U.S. Agency for International Development.

Thus far, we see no need for new legislation to implement Articles 10 and 11 of the Protocol when or if it is ratified.

Q22.3 Are Articles 10 and 11 the only articles in the Protocol that address the issue of adaptation?

A22.3 No. Article 12, which defines the Clean Development Mechanism, provides for the COP/MoP to ensure that a share of the proceeds from certified project activities is used, inter alia, to "assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation."

Q22.4 What measures are planned or underway for implementing effective adaptation?

A22.4 Because the Kyoto Protocol has not yet entered into force, and because there has been only one meeting of the Convention's subsidiary bodies since the Protocol was adopted in December 1997, the Parties have yet to plan or implement, pursuant to the Protocol, any specific measures in this regard.

Clarification of the Protocol's Article 25.1 Entry-Into-Force Provisions

Q23. Article 25.1 of the Protocol states: "This Protocol shall enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 percent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession."

However, the January 15, 1998 "Fact Sheet" on the Kyoto Protocol released by the Department of State's Bureau of Oceans and International Environmental and Scientific Affairs contained the following: "To enter into force, it must be ratified by at least 55 countries, accounting for at least 55 percent of the total 1990 carbon dioxide emissions of developed countries."

It appears to me that Article 25.1 says that the Protocol would enter into force on the ninetieth day after the date on which at least 55 Convention Parties—*which also must include* Annex I Parties that accounted for least 55 percent of Annex I Party carbon dioxide emissions in 1990—"have deposited their instruments of ratification, acceptance, approval or accession." However, the State Department "Fact Sheet" says that the Protocol would enter into force whenever it is ratified *by any* 55 Convention Parties that accounted "for at least 55 percent of the total 1990 carbon dioxide emissions of developed countries." There appears to be a contradiction between these two interpretations.

Please clarify the meaning of Article 25.1.

A23. As you note, Article 25.1 is clear on its face. The State Department "Fact Sheet," which paraphrased the entry into force requirement, was not intended to suggest a new interpretation of the Article.

Parties Covered Under Article 3.5 of the Protocol

Q24. Article 3.5 of the Protocol states: "The Parties included in Annex I undergoing the process of transition to a market economy whose base year or period was established pursuant to decision 9/CP.2 of the Conference of the Parties at its second session, shall use that base year or period for the implementation of their commitments under this Article. Any other Party included in Annex I undergoing the process of transition to a market economy which has not yet submitted its first national communication under Article 12 of the Convention may also notify the Conference of the Parties serving as the meeting of the Parties to this Protocol that it intends to use a historical base year or period other than 1990 for the implementation of its commitments under this Article. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall decide on the acceptance of such notification."

Q24.1 Please identify those "Parties included in Annex I undergoing the process of transition to a market economy whose base year or period was established pursuant to decision 9/CP.2 of the Conference of the Parties at its second session," the base year used those Parties, and the difference between each of those Party's base year emissions and each of those Party's 1990 emissions.

A24.1 Article 3.5 reaffirmed Decision 9/CP.2 allowing certain EIT Parties to use base years other than 1990. Parties which have chosen different base years include: Bulgaria (1988); Poland (1988); Romania (1989); and Hungary (the average of the years 1985 to 1987 as a base year). The following chart provides data on the base year chosen, 1990 emissions, and the difference between these figures. ["Gg" is gigagrams.]

Name	Base Year Emissions (Gg)	1990 Emissions (Gg)	Difference (Gg)
Bulgaria	95109.7	80075.9	15033.8
Poland[1]	493515.0	431320.0	62195.0
Romania[2]	207546.8	179548.1	27998.7
Hungary	82435.8	68838.2	13597.6

[1] Poland used a different inventory methodology in each year.

[2] Romania provides its emissions in terms of "kg/per capita;" total is derived by multiplying the GHG totals by the total population for each year and converting to "Gg."

Source: First National Communications (sinks included)

Q24.2 Please identify any other Party "included in Annex I undergoing the process of transition to a market economy which has not yet submitted its first national communication under Article 12."

A24.2 All Parties included in Annex I undergoing the process of transition to a market economy have submitted their first national communications under Article 12. However, since Lithuania and Ukraine made their submissions after the adoption of the Kyoto Protocol (March and February 1998, respectively), their use of 1990 as a base year must be approved by the COP/MOP under Article 3.5.

Article 18 and Kyoto Protocol Enforcement and Compliance

Q25. It is my understanding that Article 18 of the Protocol is intended to be an enforcement or compliance article. However, the development and approval of "appropriate and effective procedures and mechanisms" to determine and address cases of non-compliance have been delayed until the Protocol enters into force. Moreover, any such procedures or mechanisms "enacting binding consequences" must be adopted as an amendment to the Protocol.

Would you agree that Article 18 is weak and is not effective enforcement and compliance "for both environmental and economic competitiveness reasons," which was a prime objective of the Administration as spelled out in the U.S. Non-Paper of December 1996, and if not, why not?

A.25 Article 18 authorizes the Parties to the Protocol to develop appropriate and effective procedures and mechanisms to address cases of non-compliance. In addition, the Parties have other opportunities to deal with compliance and its enforcement in the context of the rules and guidelines to operationalize Article 6 on joint implementation, Article 12 on the Clean Development Mechanism and Article 17 on emissions trading. The United States remains committed to an effective enforcement and compliance regime for the Protocol.

U.S. Opposition to Mandatory, Harmonized Policies and Measures

Q26. On page 10 of your written testimony you state that "The United States firmly opposed mandatory, harmonized policies and measures that would be imposed upon us in order to reach our target. We prevailed. The Protocol leaves Parties entirely free to decide how best to meet their targets based on national circumstances."

Q26.1 Isn't it correct that during the negotiations leading up to the adoption of the Protocol, other countries, including the European Union were insisting that the Protocol must contain certain mandatory or coordinated policies and measures?

A26.1 Yes.

Q26.2 You have said that the Protocol "leaves Parties entirely free to decide how best to meet their targets based on national circumstances," but is it not true that Article 2.4 of the Protocol provides that "The Conference of the Parties serving as the Parties to this Protocol, if it decides that it would be beneficial to coordinate any of the policies and measures. . ., shall consider ways and means to elaborate the coordination of such policies and measures [emphasis added]"?

A26.2 One of the fundamental principles embedded in the Kyoto Protocol is the flexibility of individual nations to meet their targets in ways appropriate to their national circumstances. The U.S. successfully fought for and achieved this principle over the resistance of other Parties, including the EU, which favored harmonized policies and measures. The Conference of the Parties, as it should, retains the right to consider coordination of policies and measures when it may be beneficial to do so. In this regard, the U.S. would have to agree that it would be beneficial both to consider and whether to agree to any such policy coordination.

Q26.3 Given the above, why is it not more accurate to say that the Europeans have preserved the option to impose mandated or coordinated policies and measures rather than to suggest that the Administration succeeded in getting the Protocol to leave Parties "entirely free to decide how best to meet their targets based on national circumstances"? Is this not an issue that you expect the European Union to raise at COP-4 (or prior to COP-4) in connection with emissions trading?

A26.3 The U.S. must consent to any decision that it would be beneficial to coordinate policies and measures. No body can impose policies and measures upon us without our consent.

Implication of Article 26 (No Reservations) of the Kyoto Protocol

Q27. Article 26 of the Kyoto Protocol states: "No reservations may be made to this Protocol."

Article 19 of the Vienna Convention on the Law of Treaties provides for formulations of reservations by a State, when signing, ratifying, accepting, approving or acceding to a treaty unless:

> **"(a) the reservation is prohibited by the treaty;**
>
> **(b) the treaty provides that only specified reservations, which do not include the reservation in question, may be made; or**
>
> **(c) in cases not falling under sub-paragraphs (a) and (b), the reservation is incompatible with the object and purpose of the treaty"**

Q27.1 It is my understanding that the U.S. is not a party to the Vienna Convention on the Law of Treaties, but does view parts of it as declarative of customary international law. Is my understanding correct, and if not, why not?

A27.1 Yes.

Q27.2 Does not Article 26 of the Kyoto Protocol remove the Senate's rights to express its views on all provisions of the Protocol to impose conditions, consistent with the U.S. Constitution, in connection with Executive Branch ratification of the Protocol, and if not, why not?

A27.2 This type of clause is found in many international instruments, including in ones to which the United States is a party (and where the United States became a Party following advice and consent by the Senate to ratification), and we believe that it is does not limit the prerogatives of the Senate. It merely has the effect that, if the Senate were to insist on making a reservation, the United States would most likely be unable to become a Party to the Protocol.

Q27.3 Why did you not object to Article 26?

A27.3 The United States consistently objected to inclusion of a "no reservations" clause.

Q27.4 If Article 26 of the Kyoto Protocol removes the Senate's rights to express its views on all provisions of the Protocol to impose conditions, consistent with the U.S. Constitution, in connection with Executive Branch ratification of the Protocol, how can the U.S. possibly ratify the Protocol?

A27.4 It would not be desirable to decide in advance that no treaty to which the United States proposed to become a party may include a no reservations clause. In some cases, a no reservations clause could serve U.S. interests by ensuring that other parties do not make reservations to which the United States would object.

Implications of the Kyoto Protocol for U.S. National Security and the Ability of the U.S. Military to Meet Its Worldwide Responsibilities

Q28. On pages 8 and 9 of your written testimony you address the implications of the Kyoto Protocol for U.S. National Security and the ability of the U.S. military to meet its worldwide responsibilities. You said that it "is not true" that "the Kyoto Protocol will damage our national security or imperil the ability of our military to meet its worldwide responsibilities." And you cite the provisions of Decision 2/CP.3 that state that "emissions based upon fuel sold to ships or aircraft engaged in international transport should not be included in national totals, but reported separately," and "that emissions resulting from multilateral operations pursuant to the Charter of the United Nations shall not be included in national totals, but reported separately; other emissions related to operations shall be included in the national emissions totals of one or more Parties involved."

Q28.1 It is my understanding that the decisions of the Conference of the Parties are not legally binding. Is my understanding correct, and if not, why not?

A28.1 Whether decisions of the Conference of the Parties are legally binding depends upon the context. The decision you refer to, which was adopted contemporaneously with the Protocol, is a definitive interpretation of the Protocol.

Q28.2 It is also my understanding that none of the legally binding provisions of the Kyoto Protocol do not include any such exemptions. Is my understanding correct, and if not, why not?

A28.2 Please see Answer 28.1.

Q28.3 It is also my understanding that the U.S. would be legally bound under Article 2.2 of the Kyoto Protocol to "pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively." Is my understanding correct, and if not, why not?

A28.3 Yes.

Q28.4 On page 9 of your written testimony, you state that "If any other measures to preserve our national security interests are required, and there do not appear to be any, they can be addressed through future implementing legislation." Since you agreed to Article 26, which states that "No reservations may be made to this Protocol," how can such legislation have any meaning or force?

A28.4 Steps taken through domestic implementing legislation, which would address domestic allocation of emissions allowances, would not have the effect of changing U.S. obligations under the Protocol.

Q28.5 Given the above, why is it not accurate to say that the Kyoto Protocol has "the potential to damage our national security or imperil the ability of our military to meet its worldwide responsibilities"?

A28.5 See answers to above questions.

Implementing Legislation and/or Appropriations Needed to Carry Out the Terms of the Kyoto Protocol

Q29. Taking into consideration that the Administration did not ask for carbon cap-and-trade authority as part of its electricity restructuring proposal, what implementing legislation or appropriations are needed to carry out the terms of the Kyoto Protocol? Please provide an article-by-article analysis explaining why implementing legislation and/or appropriations are either needed or not needed.

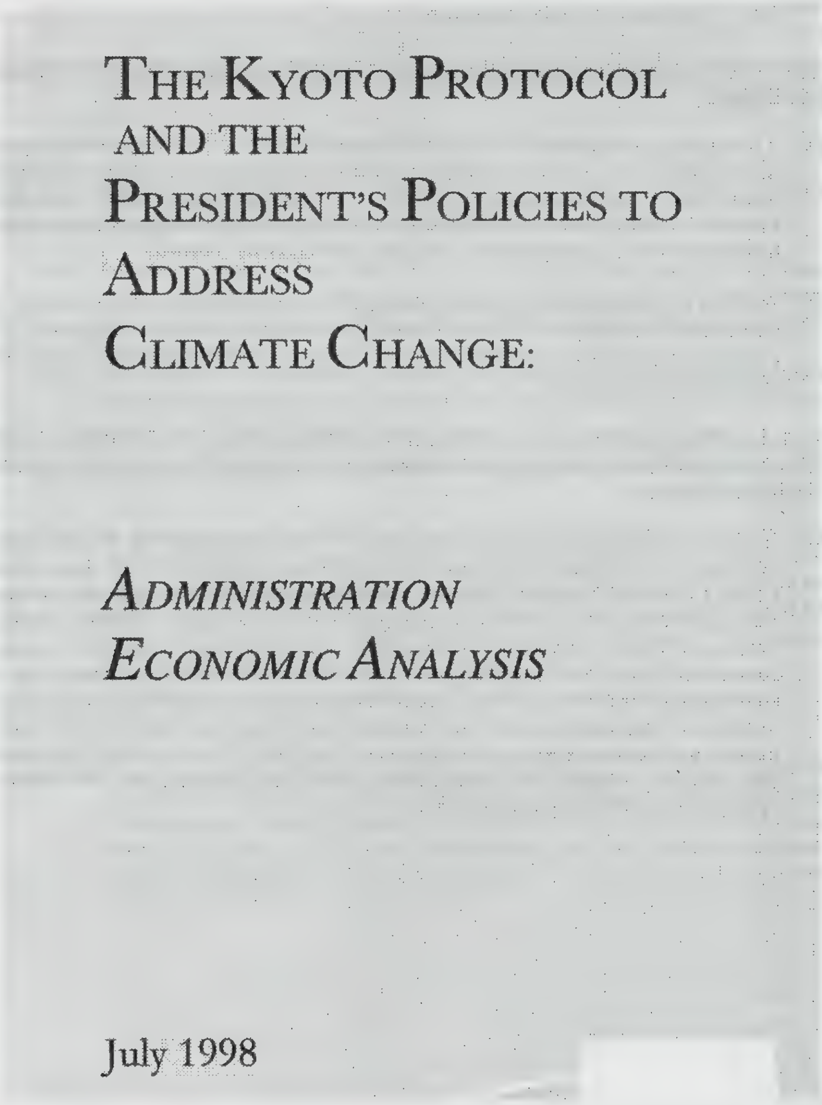
A29. The kind of article-by-article analysis referred to is normally prepared in conjunction with transmittal of a treaty to the Senate for its advice and consent to ratification. The President has made clear that he will not be submitting the Protocol to the Senate unless certain conditions are met.

March 4, 1998, Testimony of Dr. Janet Yellen, Chair, Council of Economic Advisors (CEA), before the House Commerce Subcommittee on Energy and Power on the Economics of the Kyoto Protocol

Q30. In your testimony, you made references—in your responses to Representatives Jackson-Lee, Morella, English and Ewing—to the testimony of Dr. Janet Yellen, Chair, Council of Economic Advisors (CEA), regarding her estimates of the cost of the Kyoto Protocol. However, I understand that her March 4, 1998, testimony before the House Commerce Subcommittee on Energy and Power is a series of conclusions and that she has not produced an economic analysis for our consideration and review. Also, I understand that her conclusions are based on a number of assumptions about the adoption and success of the Administration's policies and achieving Protocol commitments by 2012. You also said these modest costs will be mitigated by these policies "not even including the $20 billion in savings" from electricity restructuring.

Q30.1 Is my understanding as stated above correct, and if not, what is the correct information?

A30.1 The Administration has released an economic report describing analysis presented in Dr. Yellen's testimony. For a full discussion of the Administration's economic analysis, please refer to "The Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis, July 1998" (hereafter "the AEA"), a copy of which is attached. *(See below.)*



THE KYOTO PROTOCOL AND THE PRESIDENT'S POLICIES TO ADDRESS CLIMATE CHANGE:

ADMINISTRATION ECONOMIC ANALYSIS

July 1998

The Kyoto Protocol and the President's Policies to Address Climate Change:

Administration Economic Analysis

July 1998

EXECUTIVE SUMMARY

The primary purpose of this analysis is to examine costs and benefits of taking action to mitigate the threat of global warming. In particular, we examine costs and benefits of complying with the emissions reduction target for the United States set forth in the Kyoto Protocol on Climate Change, negotiated in December 1997. For reasons discussed at length in this paper, it is our conclusion that, with the flexibility mechanisms included in the treaty, and by pursuing sound domestic policies, the United States can reach its Kyoto target at a relatively modest cost. Moreover, the benefits of mitigating climate change are likely to be substantial.

Before considering the economics of taking action, however, we ought to step back and ask the threshold question -- whether taking action to mitigate global climate change is necessary in the first place.

The Rationale for Taking Action

The great weight of scientific authority suggests that climate change is a serious problem and that prudent steps to mitigate it are in order. In essence, we need to take out an insurance policy with reasonably priced premiums. As long ago as 1992, the National Academy of Sciences, in a study entitled *Policy Implications of Greenhouse Warming*, concluded that "...even given the considerable uncertainties in our knowledge of the relevant phenomena, greenhouse warming poses a potential threat sufficient to merit prompt responses....Investment in mitigation measures acts as insurance protection against the great uncertainties and the possibility of dramatic surprises" (p. 68).

What the science tells us is that greenhouse gases are rapidly building up in the atmosphere as a result of the burning of fossil fuels and deforestation; that the concentration of these gases is 30 percent higher than it was at the beginning of the industrial revolution; and that this concentration is expected to reach almost twice current levels by 2100 -- a level not seen in 50 million years. Theory and computer models suggest that this increased concentration of greenhouse gases could warm the Earth by about 1.8 to 6.3° F by 2100. By way of comparison, the last ice age was only about 9° F colder than today. Moreover, much evidence suggests that warming is already underway. For example, we know from ice cores and other data that we are living in the hottest century since at least 1400, that the nine hottest years since records were first kept in the late 19th century have all occurred since 1987, and that 1997 is the hottest year on record.

Scientists predict a range of likely effects from global warming. For example, the rate of evaporation is expected to increase as the climate warms, leading to increasingly frequent and intense floods and droughts. Sea level is projected to rise 6-37 inches by 2100. A 20-inch rise could inundate about 7,000 square miles of U.S. territory. Warmer temperatures would be expected to increase the risk of mortality from heat stress, aggravate respiratory disease, and increase the range and rates of transmission of some infectious diseases.

Scientific opinion is not unanimous on these points, but most independent climate scientists believe that global climate change poses real risks. A few scientists contest the notion that increasing concentrations of greenhouse gases will warm the planet, while a few others concede that the earth is indeed getting warmer, but argue that this is a good thing -- "a wonderful...gift from the industrial revolution," in the words of one. But these are distinctly minority views. The prevailing view is that the risks of climate change warrant prudent and prompt action. Prompt because to wait for greater scientific certainty could have very large costs. Greenhouse gases are long-lived and the decisions being made by governments and firms in the next decade with respect, for example, to the kinds of power plants to build or the kinds of energy sources to develop, are likely to have significant consequences for our ability to limit the buildup of greenhouse gases.

Consequently, there is a substantial rationale for acting now. Our task is to act in a manner that responds appropriately to the scope of the risk while at the same time being economically sensible.

Domestic Policy

In October 1997, the President announced a domestic program designed to reduce greenhouse gas emissions. In essence, the program contemplated (a) a set of activities that made sense as good energy and environmental policy irrespective of whether an agreement were reached in Kyoto, and (b) a mandatory domestic emissions trading system that would take effect in the 2008-2012 period if an agreement in Kyoto were reached and approved by the U.S. Senate.

The Kyoto Protocol

The Kyoto Protocol, which requires the advice and consent of the Senate, commits industrialized nations to take on binding targets for greenhouse gas emissions, and includes three basic kinds of flexibility provisions that were proposed by the United States. These provisions -- commonly referred to as "when", "what", and "where" flexibility -- have great potential to significantly lower the costs of meeting the Kyoto targets. “When” flexibility appears in the form of a multi-year commitment period (2008-2012), and allowance for “banking” of emissions reductions. The freedom for countries or companies to delay or accelerate reductions within an agreed upon time frame can help lower costs. “What” flexibility is provided by both the inclusion of all six greenhouse gases -- enabling reductions in emissions of one gas to be used to substitute for increases in emissions of another -- and the coverage of certain “sink” activities, such as afforestation or reforestation, that absorb carbon. Most important, the Protocol incorporates “where” flexibility in the form of international emissions trading and joint implementation among countries that take on binding targets, coupled with a “clean development mechanism” allowing industrial countries or firms to earn credits for projects in the developing world that reduce emissions. These mechanisms can provide opportunities for industrial countries and firms to secure low-cost reductions and for developing countries to achieve sustainable growth.

Developing countries did not take on binding emissions targets at Kyoto, although they did agree to provisions for the Clean Development Mechanism. The President has said that he will not submit the Protocol to the Senate without meaningful participation from key developing countries. While the Clean Development Mechanism provides a down payment on such participation, the Administration is actively seeking greater developing country engagement.

Costs and Benefits of Mitigation

Analyzing the costs and benefits of mitigating climate change is a difficult undertaking for three reasons. First, uncertainties remain about significant details of certain provisions in the Protocol. Second, available models have inherent limitations in their abilities to analyze even short-term costs and benefits. Third, it is extremely difficult to quantify the long-term economic benefits of climate change mitigation. Thus, while we have summarized the literature, we have not calculated a monetary value of these benefits.

Recognizing these difficulties, our conclusion is that the costs for the United States to meet its Kyoto emissions target are likely to be modest if those reductions are undertaken in an efficient manner employing the flexibility measures of emissions trading (both domestic and international), joint implementation, and the Clean Development Mechanism. This would be so even without considering the direct benefits of mitigating climate change or the impact that key additional factors -- such as the President’s domestic climate change proposals, the ancillary benefits of improved air quality, or the inclusion of sinks -- could have on lowering the net costs of mitigation.

Our conclusion concerning the costs of complying with the Kyoto Protocol is not entirely dependent upon, but is fully consistent with, formal model results. For example, given the flexibility measures noted above, with key developing countries participating in trading, and *excluding* both the benefits of mitigating climate change and the key additional factors just noted, estimates derived using Battelle's Second Generation Model (SGM) suggest that the resource costs of attaining the Kyoto targets for emission reductions might amount to $7-12 billion per year in 2008 to 2012, or just 0.1 percent of projected GDP. The same model predicts that emission permits in 2010 would cost between $14 and $23 per ton of carbon equivalent -- which would translate into an increase of about 4 to 6¢ per gallon of gasoline. The increase in energy prices would raise the average household's energy bill in 2010 by between $70 and $110 per year -- a relatively small amount compared to typical energy price changes. Moreover, this increase would be substantially offset by the decline in electricity prices resulting from the Administration's electricity restructuring proposal.

These numbers are instructive. They demonstrate the importance of flexibility measures like emissions trading and the potential for meeting our Kyoto target at a relatively modest cost. However, it is just as important to understand what these numbers do *not* say. They do not tell us about either (a) the economic *benefits* of mitigating climate change or (b) the potential for any other domestic policy measures (aside from emissions trading) to reduce costs further and/or to increase the percentage of greenhouse gas reductions we can accomplish at home. The reason is that the SGM model we used to generate these numbers does *not*, by its terms, account for either of these factors.

Benefits of mitigating climate change. There are substantial long-term benefits of mitigating global climate change. Monetary estimates of damages from the environmental, health, and economic impacts of global warming during the next century range in the tens of billions of dollars per year. One noted economist, William Cline, has estimated that a doubling of pre-industrial concentrations of greenhouse gases would cost the U.S. economy about 1.1% of GDP annually -- some $89 billion a year in today's terms. Moreover, these estimates do not reflect the potential costs of so-called "non-linearities" -- the risk that global warming will lead not to gradual and predictable problems, but to relatively abrupt, unforeseen, and potentially catastrophic consequences. Although we do not think the benefits of mitigating climate change are, at this stage, quantifiable with adequate precision, they are nonetheless likely to be real and large in the long run.

There are also ancillary benefits of reducing greenhouse gas emissions -- in particular, the corresponding reductions in conventional air pollutants like sulfur dioxide or nitrogen oxides. These benefits alone could produce savings equal to about a quarter of the costs of meeting our Kyoto target.

The impact of policies not included in illustrative analysis. Following on the President's October 1997 policy announcement, the Administration is pursuing a number of domestic initiatives that will help reduce greenhouse gas emissions. These initiatives -- all of which are consistent with our commitments under the 1992 Framework Convention on Climate Change, which the Senate approved that same year -- could reduce costs and/or increase the amount of reductions accomplished through domestic action. First, the Administration's $6.3 billion budget proposal to promote energy efficiency and renewable energy should help increase the rate of technology development and diffusion. Many of the components of this initiative reflect recommendations made in an October 1997 report by the President's Committee of Advisors on Science and Technology (PCAST), which concluded that "the inadequacy of current energy R&D is especially acute in relation to the challenge of responding prudently and cost-effectively to the risk of global climatic change...." (PCAST 1997, p. i).

Second, the Administration's electricity restructuring proposal is estimated to reduce greenhouse gas emissions in the United States by about 25 to 40 million metric tons per year. Competition would provide a direct profit incentive for generators to produce more electricity with less fuel and improve energy efficiency. Several specific provisions in the Administration's proposal would yield further emissions reductions.

Third, the Administration is conducting industry consultations aimed at promoting voluntary agreements with major energy-intensive industries, energy providers, and others to yield further emissions reductions. One such agreement, the Partnership for Advancing Technology in Housing (PATH), announced in May, established goals for voluntary improvements in home energy use that would reduce emissions in 2010 by about 24 million metric tons of greenhouse gas emissions.

Fourth, the Administration is pursuing an active program to reduce emissions produced by the federal government, the nation's largest consumer of energy.

As noted above, models like SGM, while well equipped to assess policies such as a tradable permit program, do not assess policies like these. To the extent that policies like these boost the rate at which energy efficiency improves, the United States could lower the cost of mitigation and increase the amount of reductions made domestically.

Finally, our illustrative analysis, based on the SGM model, did not account for the effects of carbon sinks in reducing net greenhouse gas emissions. Opportunities to reduce net emissions through carbon sinks could further reduce the costs of achieving the Kyoto target and increase domestic reductions.

Conclusion

The current state of the science provides a powerful rationale to take prompt, prudent action to mitigate climate change. The agreement negotiated in Kyoto includes flexibility mechanisms that will allow the United States to meet its Kyoto target at a modest cost. Additional factors not included in the modeling effort -- such as the President's domestic climate change policies, the inclusion of sinks and the ancillary benefit of improving air quality -- could lower costs even further and increase the percentage of reductions made through domestic action. The benefits of mitigating long-term impacts of global climate change, while not precise enough to quantify at this stage, are likely to be very important. In short, this is an insurance policy we should buy and it is one we can buy for reasonably priced premiums.

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INTRODUCTION

The earth's surface appears to be warming as a result of the accumulation of greenhouse gases from myriad sources worldwide. None of the emitters of these gases currently pays the cost to others of the adverse effects of warming. No individual firm, nor any single country, has an incentive to reduce emissions sufficiently to protect the global environment against climate change. Each has an economic incentive to "free ride" on the efforts of others. Without an international agreement limiting emissions abroad, even if one country sharply reduces its emissions unilaterally, greenhouse gas emissions from all other countries would continue to grow, and the risks posed by climate change would not be significantly reduced. The complex nature of the climate change problem requires global cooperation and a long-term solution.

In June of 1992, the Framework Convention on Climate Change, the first international agreement to address the risks of climate change, was signed during the Earth Summit in Rio de Janeiro. This treaty, ratified by the United States with the advice and consent of the Senate in October 1992, established the following ultimate objective:

> "[To achieve] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (Framework Convention on Climate Change, Article 2).

The Framework Convention laid the foundation for international cooperation to reduce emissions of greenhouse gases. The treaty encouraged industrial countries to return their greenhouse gas emissions to their 1990 levels by 2000.

Since the Framework Convention entered into force, the world's scientists have continued to warn of the potential negative environmental and economic effects of climate change. In 1995, the Intergovernmental Panel on Climate Change (IPCC), jointly established by the World Meteorological Organization and the United Nations Environment Programme, and representing the work of more than 2,000 scientists, concluded that "the balance of evidence suggests that there is a discernible human influence on global climate" (Houghton et al. 1996, p. 5). Without measures to abate the expected increase in greenhouse gas emissions over the next century, the IPCC projected that average global temperatures would increase by 1.8 to 6.3° F (1 to 3.5° C), resulting in coastal damage from rising sea levels, greater frequency of severe weather events, shifts in agricultural growing conditions from changing weather patterns, threats to human health from increased range and incidence of diseases, changes in availability of freshwater supplies, and damage to ecosystems and biodiversity.

To address these climate change risks better and to build on the existing treaty, approximately 160 countries met in Kyoto, Japan in December of 1997 and agreed to take substantial steps toward meeting the Convention's ultimate objective. The Kyoto Protocol, which requires the advice and consent of the Senate, would place binding limits on industrial countries' emissions of the six principal types of greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs). The Protocol embraces several flexible, market-based approaches to allow for the emissions targets to be achieved at least cost. While the Protocol includes some participation by developing countries -- for example, through the Clean Development Mechanism[1] -- it does not currently include adequate participation by key developing countries, and the Administration is working to promote such participation.

The Administration will continue its efforts to promote meaningful participation by key developing countries and will work for effective implementation rules for international trading, the Clean Development Mechanism, and joint implementation. The risks of climate change are global and thus they require a global effort. The President will not submit the Kyoto Protocol to the Senate for advice and consent until key developing countries agree to participate meaningfully.

Independent of the agreement reached in Japan, the Administration has proposed a suite of measures to reduce emissions domestically.

- Corresponding to the first stage of the three stage domestic strategy that the President announced in October 1997, the Administration has proposed a five-year, $6.3 billion package of tax incentives and R&D investments to improve energy efficiency and spur the development of renewable energy; commenced a set of consultations with our energy-intensive sectors aimed at achieving voluntary agreements on reducing greenhouse gas emissions; submitted a proposal for electricity restructuring that will reduce greenhouse gas emissions; and commenced an intensive review of how to improve the Federal government's own energy use and procurement.

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[1] For a discussion of the Clean Development Mechanism, see p. 35.

Complementing these measures are the second and third stages of the Administration's plan that would be implemented subsequent to ratification of the Kyoto Protocol.

- The second stage will include a review of our program and an evaluation of the next steps as we prepare for a market-based trading system for greenhouse gas emissions. The details of the domestic trading system would be refined and possibly tested.

- In the final stage (2008-2012), emissions reductions would occur through a domestic trading program, integrated with international flexibility mechanisms, including international trading of emissions allowances, the Clean Development Mechanism, and joint implementation.

The international agreement that was reached in Kyoto this past December is a crucial step forward in addressing global climate change. But it is only one step in a journey. Since the international effort to reduce greenhouse gas emissions is still in some respects a work-in-progress, it is not yet possible to provide a full authoritative analysis of it. However, key elements of the Kyoto Protocol and the Administration's policy, such as international emissions trading, meaningful developing country participation, inclusion of carbon sinks and six categories of gases, as well as domestic initiatives, can ensure that reductions in global greenhouse gas emissions are consistent with continued strong economic growth.

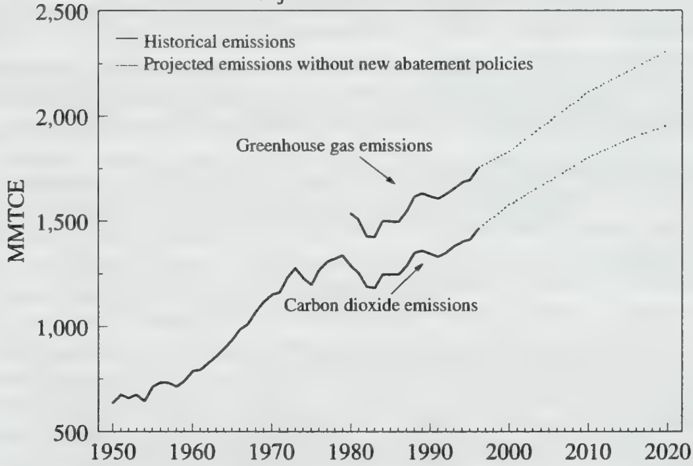
This report provides the reasoning underlying the Administration's conclusion that, with the flexibility represented by key provisions of the Kyoto agreement, and through the pursuit of sound economic policies, the economic impacts of complying with the Kyoto Protocol are likely to be modest. First, the report provides a discussion of trends in greenhouse gas emissions, both in the United States and internationally. Second, it presents a brief survey of the scientific literature on the risks of climate change. Third, it provides an overview of the Kyoto Protocol, with emphasis on its flexibility mechanisms, and the evidence in the economic literature for cost-savings through these mechanisms. Fourth, it describes the methodology used to provide illustrative cost estimates of the Administration's policy to address climate change and presents the results of this illustrative cost analysis. In addition, it discusses important elements -- such as the benefits of mitigation and the potential impact of domestic policies -- that are not factored into the model used in our illustrative cost analysis.

TRENDS IN GREENHOUSE GAS EMISSIONS

Historical Emissions

The increase in atmospheric concentrations of greenhouse gases reflects in part the growth in anthropogenic emissions of these gases. In the United States, emissions of carbon dioxide have increased more than 2 ½ times since 1950, and are projected to continue to increase over the next twenty years absent any new emissions abatement policies and efforts (see Figure 1). Most of the projected increase in domestic greenhouse gas emissions results from anticipated growth in carbon dioxide emissions; emissions of methane and nitrous oxide are likely to remain roughly flat over the next decade (Energy Information Administration 1997a; Climate Action Report 1997).[2] More than 98% of all carbon dioxide emissions in the United States

Figure 1. U.S. Greenhouse Gas Emissions, Actual and Projected without New Abatement Policies



Sources: Energy Information Administration 1997a, 1998b; Climate Action Report 1997.

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[2] A recent draft report by the Environmental Protection Agency (1998) indicates that N_2O emissions may have been higher in the past than previously reported, based on (continued...)

result from the combustion of fossil fuels (Energy Information Administration 1997b).[3] Although emissions of the synthetic gases, HFCs, PFCs, and SF_6, are projected to increase, they will still comprise only a small share of total U.S. greenhouse gas emissions in 2010 (Climate Action Report 1997).[4]

The pattern of emissions growth in the United States is similar to that of most other Annex I nations (see Figure 2) (Marland and Boden 1998).[5] In many cases, the emissions increases have tracked the output of these nations' economies. For example, the rapid development of Japan since World War II resulted in a large increase in carbon dioxide emissions in spite of that economy's high energy efficiency. Further, the nations of the Former Soviet Union have experienced a decline in their carbon dioxide emissions since the beginning of this decade because of the significant fall in economic output during their transitions to market economies.

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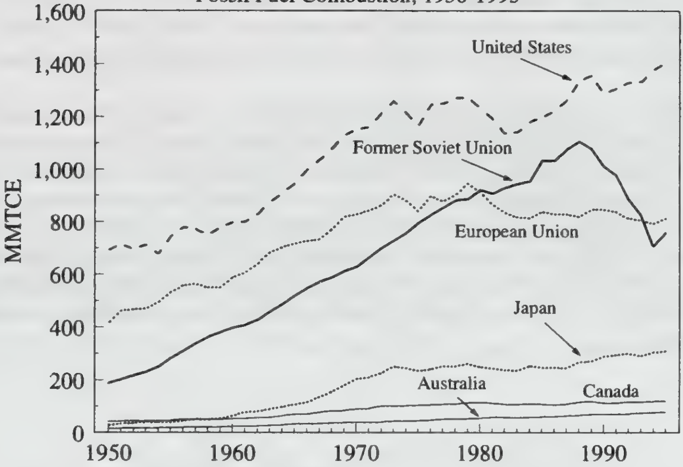
[2](...continued)
a new emissions accounting methodology. This analysis implies that future N_2O emissions may grow.

[3] Measures of carbon dioxide emissions from the Energy Information Administration and Marland and Boden (1998) do not include the effects of land use change (such as reforestation, afforestation, and deforestation) on total net emissions of carbon dioxide.

[4] Emissions of greenhouse gases are presented in terms of million metric tons of carbon equivalent (MMTCE). Carbon equivalence is based on the 100 year global warming potentials for greenhouse gases (see Table 2 for a review of global warming potentials).

[5] Annex I includes most of the world's industrial countries (see Appendix A for a description of Annex I and a list of these countries).

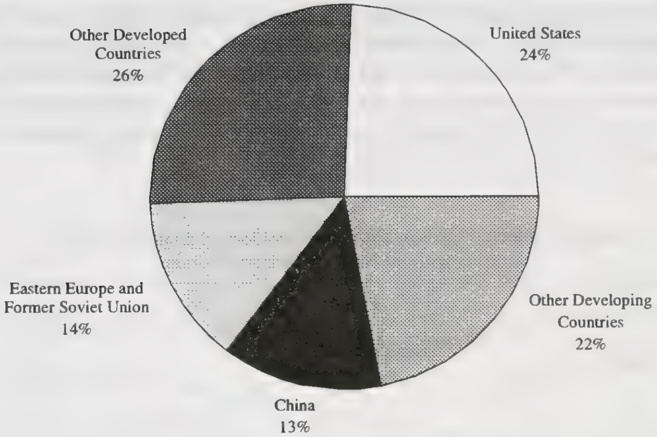
Figure 2. Major Annex I Countries' Carbon Dioxide Emissions from Fossil Fuel Combustion, 1950-1995



Source: Marland and Boden 1998.

In 1996, the industrial countries emitted a majority of the world's energy-related carbon dioxide. The United States emitted approximately 1/4 of the world's carbon dioxide from fossil fuel combustion (see Figure 3). China, the world's second largest emitter, had emissions almost equal to those of all of Eastern Europe and the Former Soviet Union. The industrial world's share of global emissions has declined over time as developing countries' economies have grown (Energy Information Administration 1998a).

Figure 3. World Carbon Dioxide Emissions from Fossil Fuel Combustion, 1996

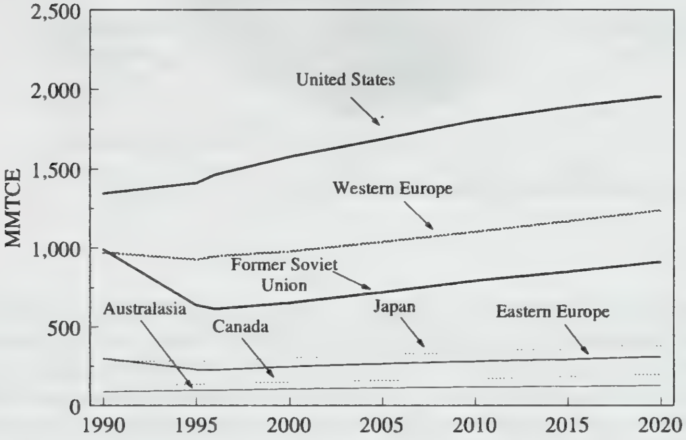


Source: Energy Information Administration 1998a.

Projected Emissions

Absent new measures to abate emissions in industrial countries, emissions of carbon dioxide will grow in all Annex I nations (see Figure 4).[6] The Energy Information Administration (1998a) projects that the United States will experience the largest absolute increase in emissions over the 1990-2020 period, while nations of the Former Soviet Union are not expected to achieve their 1990 carbon emissions level before 2020.

Figure 4. Projected Carbon Dioxide Emissions of Major Annex I Countries without New Abatement Policies



Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

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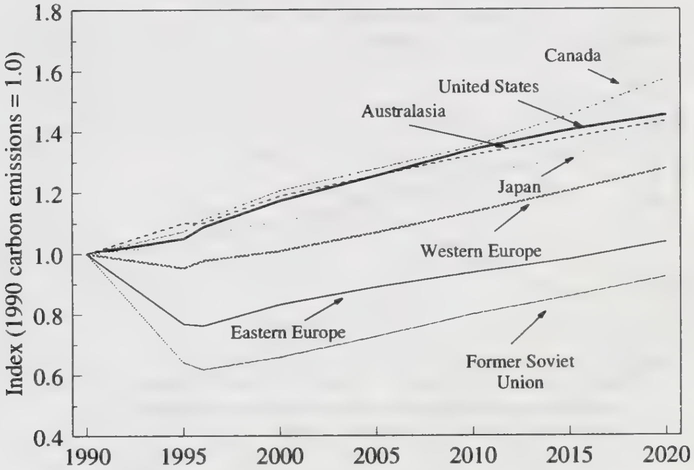
[6] The Energy Information Administration defines Australasia to include Australia, New Zealand, and U.S. Territories. Western Europe includes all of OECD Europe except for the Czech Republic, Hungary, and Poland.

The United States is projected to experience the second fastest rate of emissions growth among the major Annex I nations between 1990 and 2020 (see Figure 5). Canada is projected to experience the fastest growth rate. After declines in emissions during most of this decade, nations of the Former Soviet Union and Eastern Europe will also have comparable growth rates.

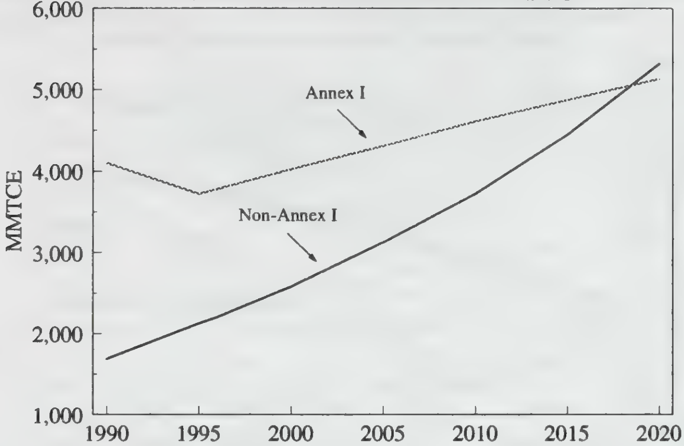
Figure 5. Projected Growth in Carbon Dioxide Emissions Among Annex I Countries without New Abatement Policies



Source: Energy Information Administration 1998a.

The Energy Information Administration (1998a) projects that Non-Annex I countries' emissions will surpass the emissions of Annex I countries between 2015 and 2020 (see Figure 6).[7]

Figure 6. Projected Emissions of Annex I and Non-Annex I Countries without New Abatement Policies



Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

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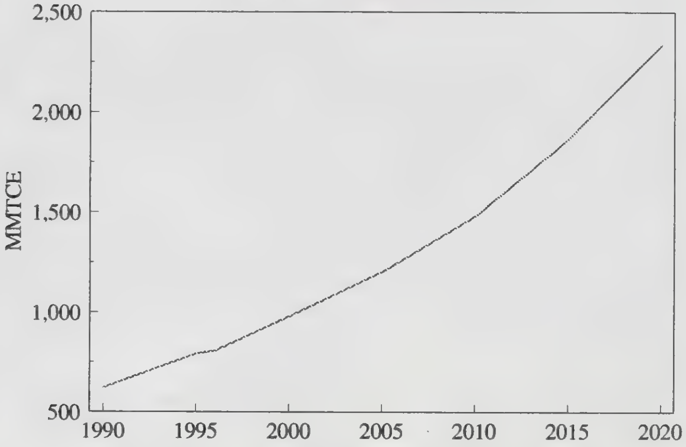
[7] See Appendix A for a discussion of Annex I and Non-Annex I countries.

According to projections, China will surpass the United States as the world's largest annual emitter of carbon dioxide around 2015 (Energy Information Administration 1998a). China's emissions will surpass 2 billion metric tons between 2015 and 2020 because of its expected rapid economic growth and its reliance on its vast coal reserves (see Figure 7).

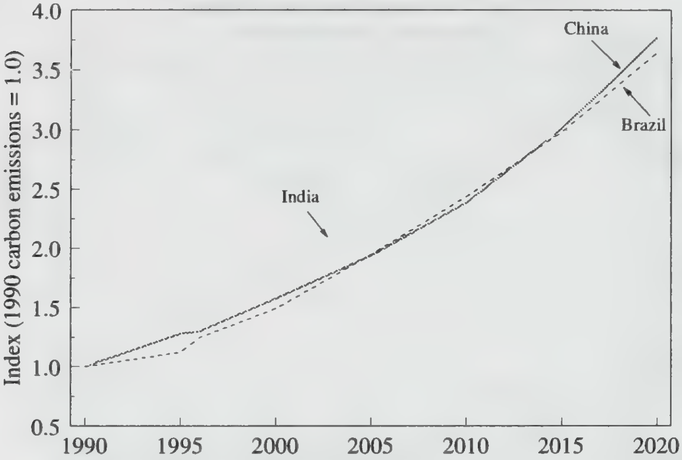
Figure 7. Projected Emissions of China without New Abatement Policies



Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

The rapid increase in Non-Annex I emissions is not solely the result of rapid emissions growth in China. The emissions of several other large developing economies are also projected to grow at nearly the same rate (Energy Information Administration 1998a; see Figure 8).[8]

Figure 8. Projected Growth in Carbon Dioxide Emissions of Several Developing Countries without New Abatement Policies



Source: Energy Information Administration 1998a.

The projected growth in emissions of carbon dioxide and other greenhouse gases can increase atmospheric concentrations of these gases, and further accelerate climate change. The next section details the risks associated with continuing along the business as usual (BAU) emissions path.

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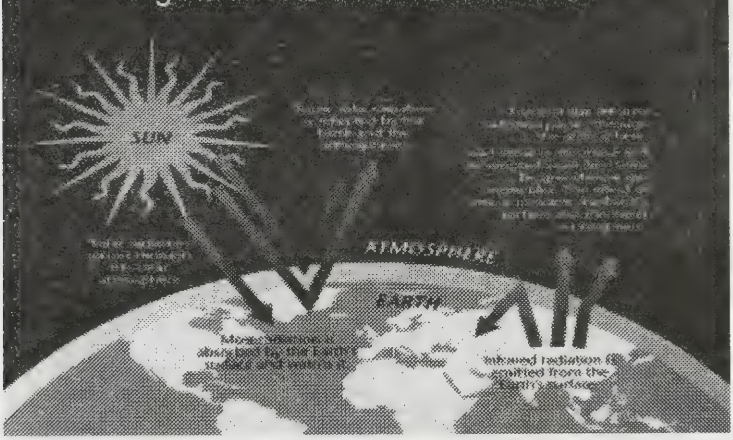
[8] For additional country-specific energy and emissions data, refer to Appendix E.

THE RISKS OF CLIMATE CHANGE

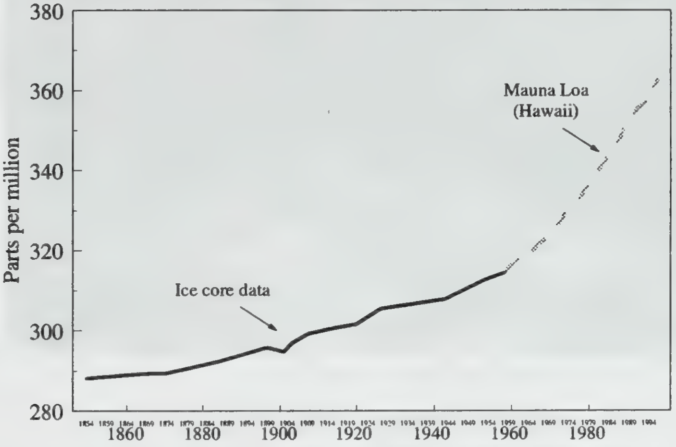
The greenhouse effect naturally warms the Earth's surface (see Figure 9). Without it, the Earth would be 60° F cooler than it is today -- uninhabitable for life as we know it. Water vapor, carbon dioxide, and other trace gases such as methane and nitrous oxide, trap solar heat by slowing the loss of heat by radiative cooling to space, thereby keeping the Earth's surface warmer than it otherwise would be.

Figure 9: The Greenhouse Effect


SUN
ATMOSPHERE
EARTH
Most radiation is absorbed by the Earth's surface and warms it
Infrared radiation is emitted from the Earth's surface

Since the beginning of the Industrial Era in the middle of the 19th century, the concentration of CO_2 in the atmosphere has been steadily increasing (Neftel et al. 1985, 1994; Keeling and Whorf 1997; see Figure 10). Beginning in 1958, continual measurements of atmospheric CO_2 concentrations have been made by scientists at an observatory on Mauna Loa, Hawaii (Keeling and Whorf 1997). The seasonal cycle of vegetation in Northern latitudes is evident in this record; each spring the vegetation "inhales" and absorbs CO_2, and each autumn most of that CO_2 is released back to the atmosphere. Overall, atmospheric CO_2 has increased over 30% from 280 parts per million (ppm) to over 360 ppm since 1860 (Schimel et al. 1996).

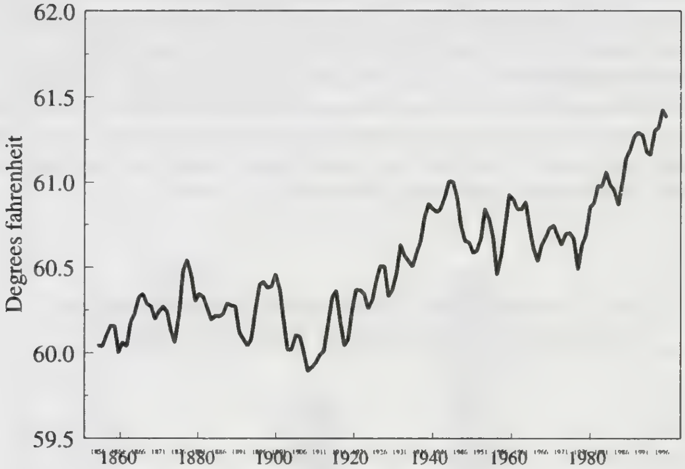
Figure 10. Atmospheric Carbon Dioxide Concentration



Sources: Neftel et al. 1985; Keeling and Whorf 1997.

Over the past century, the global average temperature has risen by approximately 1° F (Nicholls et al. 1996; Jones et al. 1998; see Figure 11).[9] Further, recent analyses have indicated that 1997 was the warmest year on record and that nine of the past eleven years have been the warmest on record (Quayle et al. 1998, Karl 1998). In addition, a recent study found that the Northern Hemisphere appears to have experienced its three warmest years since 1400 during the present decade (Mann et al. 1998).

Figure 11. Global Average Temperature



Note: Data are expressed as 3-year centered averages.
Source: Jones et al. 1998.

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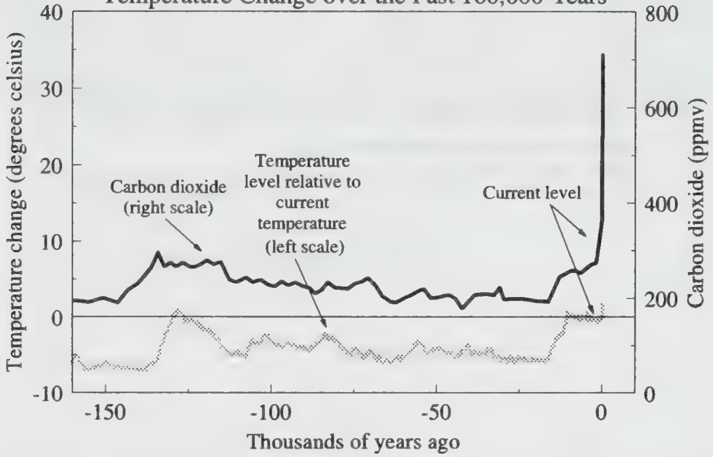
[9] The approximate 1° F temperature rise over the past century is derived from a regression analysis of the temporal data. Because the annual global average temperature is variable from year to year, it is inappropriate to simply select two years to quantify the increment. The trend or regression is a more appropriate means to calculate the century's temperature rise.

Temperature changes in recent decades bear out the close correlation between carbon dioxide concentration and temperature found in ice core data going back 160,000 years (Barnola et al. 1987, 1994). Since the beginning of the Industrial Era, the CO_2 level has increased steadily and is already outside the bounds of variability seen in the 160,000 year record (see Figure 12). Continuation of current levels of emissions is projected to raise concentrations to over 700 ppm by the year 2100, a level not experienced on Earth since about 50 million years ago. It is anticipated that if the CO_2 levels increase to this level, then the global average temperature will rise between 1.8 and 6.3° F by the year 2100 (Kattenberg et al. 1996). This range of temperature impacts was developed by the Intergovernmental Panel on Climate Change using a set of alternative plausible assumptions about climatic response to higher greenhouse gas concentrations, the effects of aerosols (such as sulfate particles) that can offset warming, and several economic parameters. In general, the temperature change experienced would be greater at higher latitudes than at lower latitudes, and greater over land than over the oceans (Kattenberg et al. 1996). Thus, temperature increases in much of the United States would be expected to be substantially greater than the average global increase.

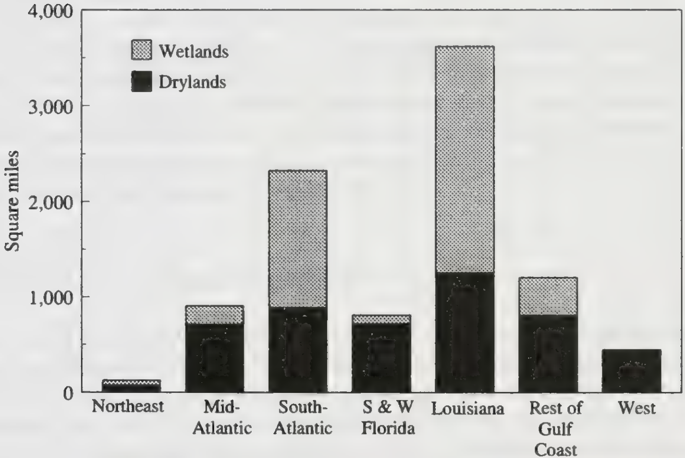
Figure 12. Atmospheric Carbon Dioxide Concentration and Temperature Change over the Past 160,000 Years



Sources: Barnola et al. 1994; Chapellaz and Jouzel 1992.

Global warming of the magnitude projected by the IPCC will have many effects due to changes in local temperature and precipitation patterns, an induced rise in sea level, and altered distribution of freshwater supplies. By 2100, sea level is expected to rise by 6 to 37 inches (Warrick et al. 1996). An average 20-inch sea level rise would result in substantial loss of coastal land in the United States especially along the southern Atlantic and Gulf Coasts, which are currently subsiding and are particularly vulnerable (Titus et al. 1991; Smith and Tirpak 1989; see Figure 13). Even if greenhouse gas concentrations were stabilized at about 560 ppm (double the pre-industrial concentration) within the next century, the sea level would continue to rise for several centuries because of the large inertia in the coupled ocean-atmosphere-climate system (Warrick et al. 1996). If the carbon dioxide concentration were to increase 1% per year until it reached approximately 560 ppm, and then were to stabilize, the sea level would continue to rise from thermal expansion alone (Manabe and Stouffer 1993, 1994).

Figure 13. U.S. Coastal Lands at Risk from a 20-inch Sea Level Rise in 2100



Note: Assumes currently developed areas are protected.
Source: Titus et al. 1991.

The effects of the global climate system described above do not include potential non-linearities in the relationships between greenhouse gas concentrations and temperature, between temperature and economic damages, or in the various other complicated relationships governing interactions among greenhouse gas emissions, the climate, and the economy. Three possibilities serve as illustrations. Warming of Northern tundra might release large amounts of methane from the subarctic permafrost, thereby acting as a positive feedback on the climate, leading to potentially devastating acceleration of an otherwise controllable global warming process (Nisbet and Ingham 1995). Second, evidence from the historic record suggests that some types of climate change might lead to abrupt changes in ocean currents, including displacement of the currents that warm Western Europe. Evidence from ocean core samples suggests such changes of ocean currents have occurred in previous ice ages (Broeker 1997). Third, warming might cause accelerated melting of the Antarctic ice sheet causing even more substantial increases in sea levels (Rott et al. 1996; Vaughan and Doake 1996). These potential nonlinearities strengthen the argument for taking prompt, reasonable steps to mitigate climate change.

OVERVIEW OF U.S. STRATEGY IN KYOTO NEGOTIATIONS AND BEYOND

The United States entered the negotiations, held December 1-11, 1997 in Kyoto, Japan, with three primary objectives. First, the agreement should include realistic targets and timetables for reducing greenhouse gas emissions among the world's major industrial nations. Second, the agreement should include an array of flexible, market-based approaches for reducing emissions. Third, the agreement should include meaningful participation of key developing countries. At the close of the Kyoto Conference, the Parties to the United Nations Framework Convention on Climate Change agreed to a Protocol to harness the forces of the global marketplace to reduce greenhouse gas emissions that reflected the first two of our objectives, and made an important down payment on the third objective.

The United States will continue its efforts to promote meaningful participation of key developing countries in bilateral and multilateral venues. In addition, the Administration will work with the other parties to the Protocol to develop rules for some of the important provisions in the agreement, including those related to international emissions trading, the Clean Development Mechanism, and carbon sinks. The Administration is working hard to make Kyoto a reality, to ensure that its critical flexibility mechanisms get up and running, and that its coverage becomes global. The following discussion details the Administration's three negotiating objectives, and their economic importance.

Realistic Targets and Timetables

The United States was committed to achieving realistic targets and timetables among developed countries that would represent a credible step in slowing the accumulation of greenhouse gases in the atmosphere, yet be measured enough to ensure continued economic prosperity. The specific limits adopted in the Protocol vary across countries, although those for the countries with the wealthiest economies are similar (see Table 1).

Table 1. Selected Annex I Countries' Emissions Targets

Country	**Emissions Target over 2008 to 2012**[10]
European Union	1990 minus 8%
United States	1990 minus 7%[11]
Japan	1990 minus 6%
Canada	1990 minus 6%
Russian Federation	1990 stabilization
Annex I Average	1990 minus 5.2%

Source: Kyoto Protocol, Annex B

Flexibility and Market Mechanisms

The ultimate economic cost to the United States and other countries of meeting the Kyoto Protocol targets depends critically on whether emissions reductions are pursued in a cost-effective manner. For this reason, the United States insisted that the Protocol include flexible, market-based provisions designed to permit our environmental objectives to be accomplished at least cost. The mechanisms would do this by establishing an international market value for emissions reductions. This will create incentives for the reductions to be made in a manner that does not waste resources or impose avoidable costs on our people or industries.

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[10] The 1990 base year actually refers to the 1990 levels for carbon dioxide, methane, and nitrous oxide and the choice of 1990 or 1995 levels for the three categories of synthetic greenhouse gases (Kyoto Protocol, Articles 3.1, 3.8). For some countries, their calculated "1990" target may thus be a hybrid of 1990 and 1995 emissions.

[11] The accounting system used in the Kyoto Protocol is different from the one used in the President's October 1997 proposal. As a result, the United States' Kyoto target represents emissions reductions no more than 3% greater than the President's October proposal (not 7%, as would appear from a surface comparison). First, the Protocol allows countries to use a 1995 baseline for the three types of synthetic gases, instead of the 1990 baseline used in the President's proposal. U.S. emissions of these gases were about 13 MMTCE higher in 1995 than in 1990 (Climate Action Report 1997). The change to a 1995 baseline for these gases implies that the Kyoto target is roughly equal to 1990 emissions minus 6%. Further, the Kyoto Protocol does not include carbon sinks in the calculation of the 1990 baseline, although certain carbon sinks will count toward meeting our 2008-2012 commitment. The omission of sinks from the Kyoto baseline changes the United States' target by about 50 MMTCE (about 3%) in comparison with the President's proposal (derived from Joyce 1995). Further, if U.S. forestry activities covered by the Protocol result in net carbon sequestration, the target will be still easier to attain.

The nature of the climate change problem suggests that flexibility and market mechanisms can substantially lower costs of achieving given levels of environmental protection. Indeed, 2,500 economists from academia, industry, and government stated in a letter signed last year advocating action on climate change that:

> "Economic studies have found that there are many potential policies to reduce greenhouse gas emissions for which the total benefits outweigh the total costs.... The most efficient approach to slowing climate change is through market-based policies" (Economists' Statement on Climate Change 1997).

The market mechanisms used to lower costs can be characterized in terms of three categories of flexibility: (1) "when" flexibility; (2) "what" flexibility; and (3) "where" flexibility, which may be the most important of all. Such methods have long been championed by economists interested in increasing the efficiency of environmental protection, as well as by those environmentalists interested in maximizing the environmental benefits of a given investment.

"When" Flexibility (Timing)

The freedom to delay or accelerate reductions within an agreed upon time frame -- while ensuring the credibility of emissions reductions -- can lower costs.

The Kyoto Protocol incorporates this principle of "when" flexibility in four ways:

- First, the period over which the initial emissions reductions occur begins and ends in a more realistic time frame than what had been proposed by many other countries. By adopting a gradual and credible path of reductions in the early years, adjustment costs can be greatly reduced while attaining the same ultimate environmental goals.

- Second, under the Kyoto Protocol, the emissions target is not stated in terms of a specific year, but rather in terms of an average over a five-year period (2008-2012) (Kyoto Protocol, Article 3.1). Averaging over five years, instead of requiring countries to meet a specific target each year, can lower costs, especially given an uncertain future. Averaging can smooth out the effects of short-term events such as fluctuations in the business cycle and energy demand, or hard winters and hot summers that would increase energy use and emissions.

- Third, there is allowance for "banking" emission reductions within the 2008-2012 commitment period for use in a subsequent commitment period, although the emission targets of the subsequent periods have not yet been specified (Kyoto Protocol, Article 3.13).

- Fourth, Clean Development Mechanism (CDM) credits achieved between 2000 and 2007 can be banked for use in the first or subsequent commitment periods (Kyoto Protocol, Articles 12.10, 3.13).

"What" Flexibility (Gases and Sinks)

"What" flexibility relates to the form the emissions reductions take and is available across two dimensions. The first is the inclusion in the agreement of all six types of greenhouse gases (Kyoto Protocol, Annex A). Emissions of different kinds of gases, not just carbon dioxide, contribute to the greenhouse effect. Reductions in emissions of one gas can be used to substitute for increases in emissions of another by an amount that has equivalent environmental effects using IPCC conversion factors for all greenhouse gases, based on their global warming potentials (see Table 2). The Kyoto Protocol stipulates that countries with binding targets are to reduce their *total* greenhouse gas emissions by certain percentages (Kyoto Protocol, Article 3.1), but does not require specific reductions for specific gases. For instance, the global warming potential per unit mass of sulfur hexafluoride is about 24,000 times greater over 100 years than CO_2, suggesting that it might be cheaper to achieve the same environmental benefit by eliminating one ton of SF_6 rather than 24,000 tons of CO_2.

The second dimension of "what" flexibility is the treatment of sinks, i.e., land use activities that promote the removal of carbon from the atmosphere through the growth of plants. Certain kinds of sinks, in particular afforestation and reforestation net of deforestation, will be used to attain the target by offsetting emissions. Promoting afforestation and reforestation may reduce atmospheric concentrations of CO_2 at much lower costs than reducing emissions of greenhouse gases resulting from industrial activity. In addition, other carbon sinks, such as agricultural soils, could be added to the list of sink activities in the future (Kyoto Protocol, Article 3.4).

Table 2. Global Warming Potentials of Greenhouse Gases Included in the Kyoto Protocol

Chemical/Species	**Chemical Formula**	**Global Warming Potential (100 year time horizon; carbon equivalence) per unit mass**
Carbon Dioxide	CO_2	0.27
Methane	CH_4	6
Nitrous Oxide	N_2O	85
HFC-23	CHF_3	3,191
HFC-32	CH_2F_2	177
HFC-41	CH_3F	41
HFC-43-10mee	$C_5H_2F_{10}$	355
HFC-125	C_2HF_5	764
HFC-134	$C_2H_2F_4$	273
HFC-134a	CH_2FCF_3	355
HFC-152a	$C_2H_4F_2$	38
HFC-143	$C_2H_3F_3$	82
HFC-143a	$C_2H_3F_3$	1,036
HFC-227ea	C_3HF_7	791
HFC-236fa	$C_3H_2F_6$	1,718
HFC-245ca	$C_3H_3F_5$	153
Sulfur hexafluoride	SF_6	6,518
Perfluoromethane	CF_4	1,773
Perfluoroethane	C_2F_6	2,509
Perfluoropropane	C_3F_8	1,909
Perfluorobutane	C_4F_{10}	1,909
Perfluorocyclobutane	$c\text{-}C_4F_8$	2,373
Perfluoropentane	C_5F_{12}	2,045
Perfluorohexane	C_6F_{14}	2,018

Source: Houghton et al. 1996, p. 22 and adjusted based on carbon content of CO_2.

"Where" Flexibility (International)

Greenhouse gas emissions have the same environmental consequences regardless of where in the world they occur. Therefore, the least-cost approach to controlling climate change is to reduce emissions wherever such reductions are cheapest. The Kyoto Protocol includes three important cost-saving provisions of this nature.

- First, it provides for countries that take on binding targets -- at present the industrial countries -- to trade greenhouse gas emissions allowances with each other (Kyoto Protocol, Article 17, initially referred to as Article 16bis). This market in emissions allowances could ensure that emissions reductions occur where they are least expensive within the industrial countries. In particular, U.S. companies could purchase emissions reductions in other participating countries when doing so would reduce their costs -- thus lowering costs without diminishing the level of environmental protection. It is worth noting that regardless of where the reductions take place, countries and their people will bear the cost of ensuring reductions sufficient to meet their specific Kyoto targets, while everyone will enjoy the environmental benefits.

- Second, the agreement provides for joint implementation by Annex I countries (Kyoto Protocol, Article 6). Thus if some industrial countries do not develop programs to trade allowances internationally, U.S. firms could nonetheless implement projects in those countries for which they could receive emissions reduction credits in the United States.

- Third, the agreement allows industrial countries or firms in those countries, through the Clean Development Mechanism, to invest in "clean development" projects in the developing world and use certified emissions reductions from these projects toward meeting their targets (Kyoto Protocol, Article 12). Investment in these kinds of projects would promote sustainable development in developing countries. Many such clean development projects may be quite inexpensive, measured in terms of the cost per ton of emissions avoided, as has been illustrated by the U.S. joint implementation pilot program. The low cost implies that both developing countries and industrial countries could benefit through these clean development efforts.

Opportunities for Cost-Savings through International Trade in Emissions Allowances

One of the primary principles of classical and neoclassical economics is that trade can make the participating parties better off. In the case of reducing greenhouse gas emissions, trade in emissions allowances could reduce the costs of firms and/or countries with higher abatement costs because they can choose to pay low-cost abaters to further reduce their emissions. Similarly, countries with lower abatement costs are better off by participating in international emissions markets because of the net income they can earn by selling emissions allowances abroad. This is no different from high-cost producers of any good wanting to buy at lower world market prices from willing exporters. If a firm finds it relatively costly to "produce" an emissions reduction, it may find it economically advantageous to purchase emissions from low-cost "producers". An international market for emissions also would create incentives for high-cost producers to innovate and find ways to become low-cost producers, and thus sellers of emissions. A wide range of both formal and anecdotal evidence shows that the flexibility mechanisms, particularly trade in emissions, would allow the world to achieve global emissions reductions at substantially reduced cost. Given the magnitude of the reductions necessary, an effective trading system would be needed to achieve our environmental goals while minimizing the cost and disruption to our people and firms.

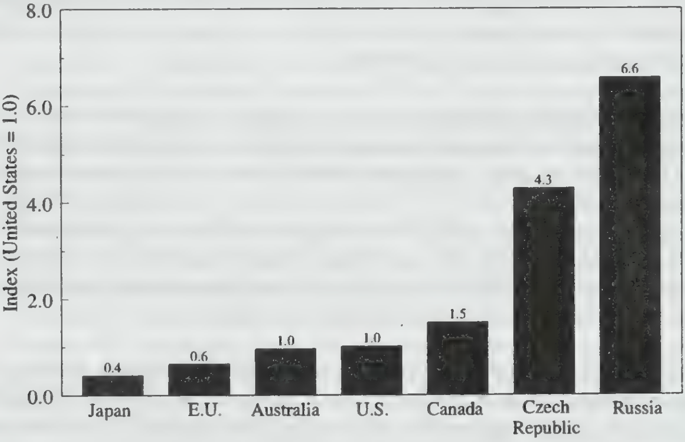
The benefits of achieving emissions reductions targets through international trading have been evaluated by numerous economists in the energy modeling community. Barrett (1992), for example, found that stabilizing emissions country-by-country could cost the European Union (E.U.) 50 times as much as stabilizing emissions for the E.U. as a whole. OECD's GREEN model shows that the costs of abatement vary among regions of the globe with comparable emissions targets by a factor of 10 (Burniaux et al. 1992). GREEN also indicates that allowing trade among regions would lower worldwide compliance costs by a factor of two.

The Stanford Energy Modeling Forum (EMF) conducts exercises with a set of energy-economic models to assess hypothetical energy policy scenarios. In the EMF-14 exercise, six models assessed two emissions pathways over the next 100+ years to achieve a 550 ppm carbon dioxide concentration target. For these two emissions pathways, the models calculated the economic costs of reducing emissions with and without international trading. While the magnitude of the cost-savings varied across models, the finding that trading reduces costs among the group of trading partners was very robust. In the six models included in the EMF exercise, international trading reduced the cost of meeting the global emissions targets by nearly 60% (Weyant 1997).

In addition to the results of formal economic models, several key descriptive statistics also clearly illustrate the opportunities for economic gains from the trade of emissions allowances. For example, several Annex I countries have higher energy-to-GDP ratios than the United States (see Figure 14). Since these countries are less energy efficient than the United States, they present potentially attractive opportunities for U.S. firms to engage in trading and joint implementation projects, thereby securing reductions at relatively lower cost than might be available in the United States.

Several other Annex I countries, including Japan and the European Union are, on average, more energy efficient than the United States. These countries may find it relatively more expensive than U.S. firms to reduce carbon dioxide emissions domestically because they have already “squeezed out” most of the inexpensive improvements in energy efficiency.

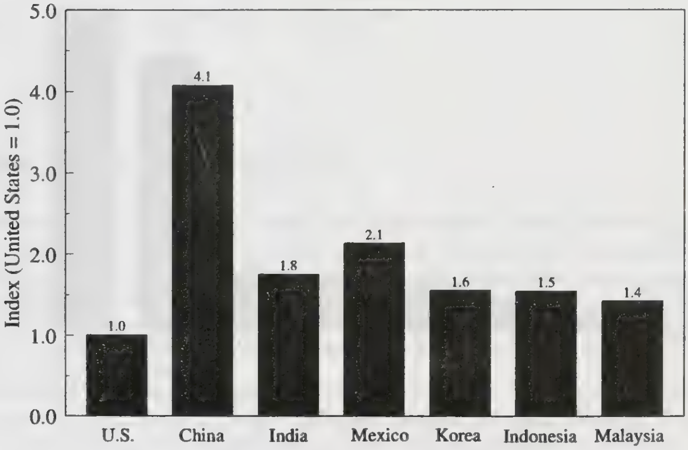
Figure 14. 1995 Energy/GDP Ratios for the U.S. and Several Other Annex I Countries



Source: Energy Information Administration 1997c.

Many large Non-Annex I countries also have much higher energy-to-GDP ratios than the United States (see Figure 15). A system of international emissions trading would provide the economic incentive for these countries to accelerate their transition to an energy efficient and carbon-lean economy. The very high energy intensity of many Non-Annex I countries suggests that many investments in energy efficiency would quickly pay for themselves, yielding negative-cost reductions. These low-cost opportunities could provide alternative options for U.S. firms to reduce emissions inexpensively through the Clean Development Mechanism, and, if developing countries adopted emissions targets, through international emissions trading. The Clean Development Mechanism and international trading would benefit both the industrial countries and the developing countries. For example, Chinese coal-fired boilers are about 25 percent less efficient than the norm for industrialized countries. If China's industrial boilers achieved typical international efficiency levels, then carbon emissions from these boilers would fall 15 to 20 percent and China's total emissions could fall by 5 percent (The World Bank 1996). A recent World Bank study concluded that China could reduce its coal consumption by 20 percent by adopting best practice technology in their power and industrial sectors (The World Bank 1997a). If China adopted a growth emissions target and undertook sensible "no regrets" actions to achieve these emissions reductions, they would make their economy better off even before they gain the benefits from selling their excess emissions in the international trading market.

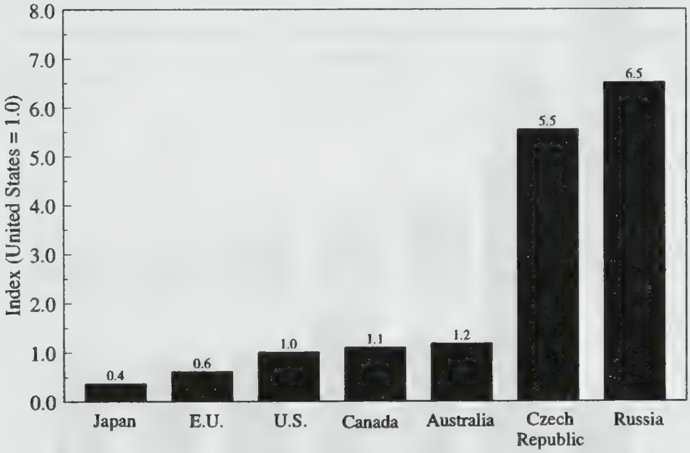
Figure 15. 1995 Energy/GDP Ratios for the U.S. and Several Developing Countries



Source: Energy Information Administration 1997c.

Similar to cross country comparisons of energy/GDP ratios, international comparisons of carbon dioxide emissions per unit of GDP provide insights on the opportunities for gains from trade. Countries vary by nearly two orders of magnitude in emissions of energy-related carbon dioxide per unit of GDP. At the low end are the poorest countries of sub-Saharan Africa: Rwanda, Burundi, Mali, and Chad. These are pre-industrial economies that still rely primarily on animal and human power supplemented by wood and crop wastes rather than commercial fuels and their energy markets are underdeveloped. The OECD countries lie in the middle of this range. Within the OECD, countries with low population density, an abundance of fossil fuels, a cold climate, or large average dwelling size use more energy per unit of GDP. Thus, Canada, Australia, and the United States are among the most carbon intensive in the OECD. Industrial countries undergoing an economic transition away from central planning are more carbon-intensive than most OECD countries. For every unit of output in Russia, more than six times the carbon is emitted than for the same amount of economic output in the United States (see Figure 16). These very high ratios in the former Soviet bloc countries are in part a result of the economic inefficiencies of central planning, including artificially low prices for coal and other fossil fuels, which in some cases still remain today.

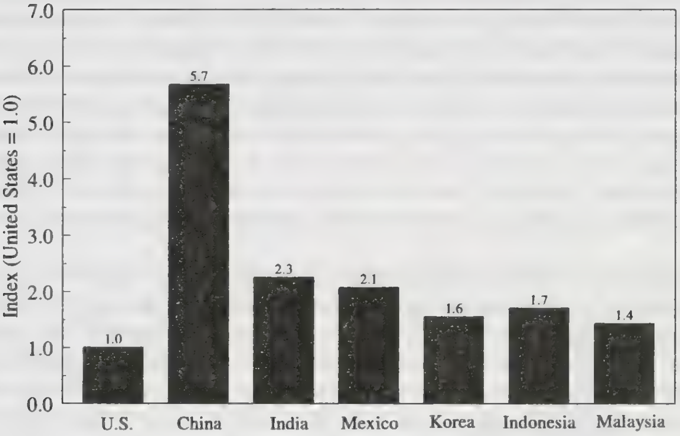
Figure 16. 1995 Carbon/GDP Ratios for the U.S. and Several Other Annex I Countries



Source: Energy Information Administration 1997c.

China's economy is also carbon-intensive, primarily because of its reliance on coal for electricity generation. Other countries with high carbon emissions per unit of GDP include India, Indonesia, and Mexico (see Figure 17). All these countries are in the middle stages of industrialization, and most have large coal or oil reserves.

Figure 17. 1995 Carbon/GDP Ratios for the U.S. and Several Developing Countries



Source: Energy Information Administration 1997c.

Making International Trading Work

Since the agreement in Kyoto, there have been several events signaling interest in transforming the concept of international trading into a practical, workable system. An early carbon emissions trade between two North American firms, a private sector proposal for an E.U. trading system, and cooperation among the Group of Eight countries illustrate this interest.

In March of this year, Niagara Mohawk Power of New York agreed to sell Suncor Energy of Canada 100,000 metric tons of greenhouse gas emissions reductions, with an option for up to 10 million tons over a 10-year period. The value for this agreement could potentially reach about $6 million. Niagara Mohawk plans to use some of the proceeds of the sale to undertake measures to reduce greenhouse gas emissions, such as improving power plant performance and energy efficiency and developing renewable energy resources. Suncor Energy will secure emissions reductions at a lower cost than what it would have to pay to achieve the same reductions through measures at their own facilities. A third party, the non-profit Environmental Resources Trust, will document the emissions reductions to be undertaken by Niagara Mohawk.

In May, the International Petroleum Exchange (IPE) of London submitted a proposal to establish a market in carbon dioxide emissions to the European Commission. The proposal calls for developing an emissions market in the United Kingdom and then expanding it throughout the European Union. The IPE recommends that free markets be allowed to evolve and anticipates that a bilateral over-the-counter market and a futures market would likely evolve. A tracking system for emissions permits would be designed, and the IPE would play a role in accounting for emissions data and reconciling trades. In terms of the nature of the tradable permit, this proposal recommends that permits be denominated in units of carbon dioxide emissions, where emissions would be calculated from the quantity of carbon-based fuels used.

Also in May, the G-8 Summit in Birmingham, England yielded an agreement to work cooperatively on international trading, other flexibility mechanisms, and developing country participation. The Final Communique of the Summit noted that the G-8 countries "aim to draw up rules and principles that will ensure an enforceable, accountable, verifiable, open and transparent trading system." Continued cooperation among these countries could result in rules that would serve as the foundation for effective private sector trading in greenhouse gas emissions.

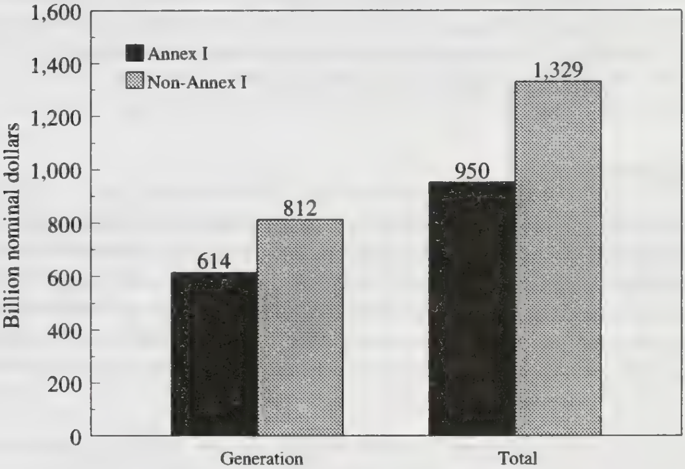
High Rates of Growth and Investment

Because of their high growth rates, developing countries have greater opportunities than the OECD to reduce emissions relative to baseline projections by installing new, carbon-efficient plants and adopting other new technologies. In contrast to retrofitting existing plants, new investment in carbon-efficient plants is a less costly approach to abate emissions.

Non-Annex I countries accounted for only 18 percent of world GDP in 1994 -- and only $790 in GDP per capita, compared to $12,200 for Annex I (Panayotou and Sachs 1998). At the same time Non-Annex I GDP grew at 5 percent annually (1990 to 1994), compared to 1.2 percent for Annex I. This has important implications for abatement opportunities.

Although Annex I countries still have, as a group, much higher economic output than Non-Annex I countries, the faster economic growth in Non-Annex I countries implies higher rates of investment. For example, investments in electric power generation are projected to be greater in Non-Annex I than in Annex I through 2010 (Energy Information Administration 1998a; see Figure 18). Many of these Non-Annex I investment projects are likely to increase total generation, while a larger share of Annex I investments will likely replace existing power plants. When a power company in an OECD country considers building a new plant to replace a plant that is not near the end of its useful life, it weighs the total cost of building a new natural gas plant against the variable cost of continuing to operate its existing coal plant. Unless coal prices jump, or the existing plant is in poor repair, only a large rise in coal prices will justify scrapping the old coal plant. In contrast, when a power company considers building a new plant in a developing country it weighs the total cost of building a new natural gas plant against the total cost of building a new coal plant. Here, a small rise in coal prices would be sufficient to justify the decision to build a gas plant.

Figure 18. Cumulative Projected Electric Power Investments, 1995-2010



Source: Energy Information Administration 1998a.

Market Distortions

Eliminating energy subsidies

Many developing countries and economies in transition continue to subsidize energy consumption. Elimination of such subsidies would represent opportunities to reduce government outlays and possibly taxes, while at the same time reducing carbon emissions and enhancing energy efficiency. Reduced reliance on fossil fuels would also reduce local air pollution, to the benefit of local public health and the local environment.

- Over 1995-1996, fossil fuel subsidy rates were 31 percent in Russia, 20 percent in China, and 19 percent in India (The World Bank 1997b). Eliminating these subsidies would substantially improve energy efficiency.

- Removing energy subsidies in Russia, China, India, Eastern Europe, Egypt, and Mexico and other non-OECD countries could decrease carbon emissions by 10 to 12 percent by 2010 (Larsen and Shah 1995). Removing these subsidies would also reduce SO_2 and particulate emissions significantly.

Management reforms

Another important opportunity for reducing carbon emissions lies in deregulation and reform of the energy sector. Reducing transmission losses for electricity, improving power quality, and better coordinating supply and demand in electric and gas systems can reduce private costs and carbon emissions at the same time. Individual customer metering, uncommon in many developing countries and economies in transition, would reduce needless energy consumption by providing an incentive for efficient use.

Opportunities for Cost-Savings through the Clean Development Mechanism and Joint Implementation

As noted, the Clean Development Mechanism (CDM) will allow companies in industrial countries to enter into cooperative projects to reduce emissions in developing countries -- such as the construction of high-tech, environmentally sound power plants -- for the benefit of both the companies and the developing countries (Kyoto Protocol, Article 12). The companies will be able to reduce emissions at lower costs than they could at home, while companies in developing countries will be able to receive the kind of technology that can allow them to grow more sustainably. The CDM will certify and score projects. This market-based mechanism provides opportunities for U.S. companies to meet emissions targets at lower costs and increases the opportunities to export energy and environmental protection technology to the emerging markets in developing countries. The CDM would build on the growing U.S. energy efficiency and environmental protection export industry (Berg and Ferrier 1997).

Joint Implementation (JI) will allow for companies in countries with emissions targets (Annex B countries) to invest in projects that reduce greenhouse gas emissions in other Annex B countries (Kyoto Protocol, Article 6). Like the CDM, this is a voluntary program that provides companies the flexibility and the opportunities to make good business decisions that result in emissions reductions at least-cost.

The CDM and JI will likely reflect many components of the existing Activities Implemented Jointly pilot program (AIJ). Under the 1992 Framework Convention on Climate Change, the U.S. government and others have commenced projects with characteristics similar to those that might be expected through the Clean Development Mechanism and Joint Implementation.

U.S. Efforts

To implement the pilot phase of the AIJ component of the Framework Convention, the Administration initiated the U.S. Initiative on Joint Implementation (USIJI) in 1993. The USIJI program supports the development and implementation of voluntary projects between U.S. and non-U.S. partners that reduce, avoid, or sequester greenhouse gas emissions. Projects are assessed based on a set of criteria that ensures proposed projects provide greenhouse gas reduction benefits and support the development goals of the host country.

As of June 30, 1997, the USIJI program had accepted 25 project proposals in 11 countries, helping U.S. firms tap the potential outside the OECD for low-cost greenhouse gas reductions while contributing to development goals in host countries (Environmental Protection Agency 1997). These projects include fuel switching, energy efficiency improvements, renewable energy, afforestation, reforestation, and improved agricultural management. A brief summary of a sample of these projects follows.

- In the Czech Republic, the District Heating Project converted the Bynov District Heating Plant from a lignite coal burning facility to a natural gas-fired plant. In addition, a cogeneration facility for steam and electricity generation have been constructed. The project developers have estimated that this activity implemented jointly will achieve total carbon emissions reductions of about 166,000 tons of carbon equivalent (Environmental Protection Agency 1997).

- In Costa Rica, the Klinki Forestry Project arranges with farmers to plant Klinki trees and other fast-growing, high-sequestration tree species on marginal farmland and pastures. Participating farmers, who sign a 40-year contract, receive tree seedlings, technical assistance, and a cash payment. The trees yield a high-grade industrial wood, suitable for utility poles and plywood, both of which continue to store carbon. Project sponsors estimate that this project will sequester nearly 2 MMTCE over its 46 year life (Environmental Protection Agency 1997).

- In Belize, the BEL/Maya Biomass Power Generation Project involves the construction of an 18 megawatt biomass waste-to-energy facility adjacent to a sugar mill. This facility will provide power to the mill, local orange processors, and an electricity distribution firm. The biomass power plant will displace diesel oil-fired power generation, and achieve total carbon emissions reductions of 1.2 MMTCE according to project sponsors (Environmental Protection Agency 1997).

- In Russia, the Fugitive Gas Capture Project involves the capturing of fugitive methane emissions from two natural gas compressor stations. Over the approximate 25 year lifetime of this project, sponsors indicate that sealing valves at the compressor stations could reduce methane emissions by more than 7 MMTCE (Environmental Protection Agency 1997).

Other Countries' Efforts

Several European countries have also embarked on AIJ projects (Zollinger and Dower 1996).

- In 1996, the Netherlands set aside $51 million for AIJ projects in 5 countries: Bhutan, the Czech Republic, Ecuador, Hungary, and Uganda.

- Norway funds a coal-to-gas conversion project in Poland, through the World Bank and the GEF. Norway has another AIJ project with Mexico.

- Germany has 7 AIJ projects, in the Czech Republic, Indonesia, Jordan, Latvia, Portugal, and the Russian Federation. These focus on fuel switching, energy efficiency, and renewable energy.

In addition, at least 6 other developed countries have included activities implemented jointly in their national action plans: Canada, Japan, Denmark, Finland, Iceland, and Sweden. The group of potential host countries continues to grow. Projects have been launched or proposed in 17 countries. Thirty-two projects have received approval from both host and sponsor governments (Zollinger and Dower 1996). Bolivia, all 7 countries of Central America, Chile, Pakistan, and South Africa have signed statements of their intent to launch cooperative projects with the United States.

Developing Countries

Clearly, the challenge of climate change cannot be addressed adequately unless developing countries take measures themselves to limit greenhouse gas emissions. Our third objective in the Kyoto negotiations was to secure meaningful participation by key developing countries. The Kyoto Protocol does include a down payment on developing country participation through the Clean Development Mechanism (see discussion above) and other provisions. However, developing countries will need to do more to participate meaningfully in the effort to combat global warming. The President will not submit the Kyoto Protocol to the U.S. Senate for its advice and consent unless key developing countries more fully participate in the international efforts to address climate change.

It should be noted that the term "developing country" encompasses a wide range of nations which are at various stages of industrialization and contribute differently to global emissions. Accordingly, there is no one-size-fits-all approach to measuring developing country participation. A country with a relatively high per capita GDP or one that emits a proportionally large share of global emissions should be expected to do more than one that is extremely poor or whose emissions are negligible.

Meaningful participation implies different actions for different kinds of countries. For example, a developing country could voluntarily adopt an emissions target. Many developing countries were opposed to emissions targets during the Kyoto negotiations on the grounds that such targets would slow their economic development. However, emissions targets and approaches that reflect developing countries' needs to grow could facilitate their development while lowering the global costs of achieving the objectives provided in the Kyoto Protocol.

If a developing country chooses to adopt a growth target and participates in international emissions trading, it could potentially enjoy substantial economic and environmental gains. Because developing countries can achieve emissions reductions relatively cost-effectively, they could reduce emissions below their target and sell their excess allowances to firms in other countries that find it in their best interest to comply with emissions targets at the lowest possible cost. Even with this participation, a country's emissions could continue to grow beyond current levels, as economic development continues. More importantly, such an approach provides both an incentive for firms to invest in energy efficient technologies in developing countries and the opportunity to export emissions allowances. While the Clean Development Mechanism can result in similar activity, it would likely occur on a smaller scale than what would be anticipated under an emissions target with effective international trading.

A world with broad-based participation in international emissions trading, including participation by Non-Annex I countries with growth targets slightly below their business as usual projections, would likely result in lower global greenhouse gas emissions relative to a world with more narrow participation. Moreover, reductions in greenhouse gas emissions would generate ancillary air quality benefits through reductions in sulfur dioxide, nitrogen oxides, and particulate matter emissions. In many large cities in developing countries the emissions of these air pollutants are a significant environmental health problem, and emissions reductions consistent with efforts to address climate change could assist in remedying this problem.

As noted earlier, trading, as a voluntary activity, benefits all parties involved. While developing countries may benefit from adopting a target and participating in trading, so would firms in developed countries.

ASSESSING THE COSTS AND BENEFITS OF REDUCING GREENHOUSE GAS EMISSIONS

Preliminary Assessment

The Administration employed a variety of tools to assess the various possible costs and non-climate benefits of our emissions reduction policy. Our overall conclusion is that the net costs of the Administration's policies to reduce emissions are likely to be relatively modest, assuming those reductions are undertaken in an efficient manner with effective international trading, the Clean Development Mechanism, meaningful developing country participation, and sound domestic policies. That potential small net premium, even excluding the benefits of mitigating climate change, purchases a partial insurance policy against a serious environmental threat. Further, although we think the economic benefits of mitigating climate change are subject to too many uncertainties to quantify, those benefits over time are likely to be real and large (see p. 69).

In reaching this conclusion, the Administration has drawn on the insights of a wide range of models of the energy sector and economy over the next 25 years, including but not limited to the results of the Stanford Energy Modeling Forum (Gaskins and Weyant 1993, Weyant 1997), the Intergovernmental Panel of Climate Change's review of the economic and social dimensions of climate change (Bruce et al. 1996), the work of the OECD on the economic dimensions and policy responses to global warming (OECD 1998), and the Administration's staff-level interagency analysis (Interagency Analytical Team 1997). In addition, the Administration used other tools, such as a meta-analysis (Repetto and Austin 1997), overviews of the domestic and international energy sectors (Energy Information Administration 1997a, d), simple statistics regarding energy efficiency, greenhouse gas emissions, and economic indicators from World Bank, International Energy Agency, and Energy Information Administration databases, and basic economic reasoning.

The conclusion that the impact of the Administration's policies to address the risks of climate change will be modest is not entirely dependent upon, but is fully consistent with, formal model results. The Administration continues to believe that there are limitations to relying on any single model to assess the economic impact of the Kyoto Protocol. However, model results can further inform and improve the understanding of the effects of climate change policy. To complement the economic analysis of the Administration's policy to address climate change, we have conducted

an illustrative assessment with a modified version of the Second Generation Model. The results from the SGM substantiate the conclusion that the economic effects of an efficient, effective, and global policy to address the risks of climate change will be modest.

Difficulties of an Economic Analysis of Climate Change

The difficulties associated with economic analysis of climate change fall into three broad categories. First are the uncertainties that still remain over the operational considerations of the treaty, necessitating assumptions on which the analysis is predicated. Second are the inherent limitations of available models to analyze the costs of abating emissions. Third, it is extremely difficult to quantify the long-term economic benefits of climate change mitigation, although such benefits are the motivation for the Kyoto Protocol. Economists have a difficult time projecting the behavior of the economy over the next quarter or year, let alone over the next two decades. The scale of the forecasting exercise is therefore daunting, and any specific results should be treated with substantial caution.

Uncertainties in the International Effort to Combat Climate Change

The Kyoto Protocol provides the foundation for the international effort to address climate change. However, the Protocol is still a work-in-progress. Uncertainties about the ultimate characteristics of the international climate change policy regime provide challenges in conducting an economic assessment.

For example, some of the rules pertaining to the flexibility mechanisms in the Kyoto Protocol, such as emissions trading and carbon sinks, require further delineation. These issues and others, including the role of developing countries, will be addressed in future negotiations.

More importantly, the international community has not yet negotiated agreements to limit greenhouse gas emissions beyond the 2008 to 2012 window. The emissions targets established in Kyoto provide for the first of many necessary steps to address the risks of climate change. The first step is critical because it sends a signal to the private sector regarding the value of reducing greenhouse gas emissions and it begins the task of reducing emissions relative to the business as usual path. However, subsequent steps are also necessary to address climate change risks adequately. Lack of knowledge regarding what the subsequent steps will be complicates any analysis of climate change mitigation.

Inherent Limitations of Models

In addition to these uncertainties about the details of the international effort to address climate change, there are the inherent limitations of the models used to evaluate that effort. Even within a given model, answers depend critically on the precise nature of the question asked. For example, the costs of emissions reductions depend on the extent of global participation and international trading that a treaty is assumed to feature. But in addition to the dependence of the results from a given model on the precise assumptions, different models can give different answers even when all the assumptions are specified to be the same -- a concrete illustration of the range of uncertainty surrounding the predictions of any one individual model.

Benefits of Averting Climate Change

As discussed in the risks of climate change section, it is evident that the benefits of averting climate change are potentially very large. There are several difficulties associated with monetizing the benefits of averting the risks of climate change. First, there is the uncertainty relating to the specific effects of climate change (e.g., would the planet be 2 or 6 ° F warmer in 2100, or some level within that range, without any measures to abate emissions). Second, the uncertainty over the extent that benefits should be discounted because they occur in the distant future presents challenges. Since the benefits of stemming future climate change accrue over not only decades but centuries, small changes in the discount rate can produce substantial changes in the results. Third, the benefits depend on global emissions paths after the 2008 to 2012 budget period specified in Kyoto. To calculate the benefits of averting climate change-induced damages, it is necessary to know the emissions path for many years beyond 2012. Thus while the benefits of getting started on the Kyoto path to reducing greenhouse gas emissions may be large over time, we cannot estimate these benefits without knowing where the path goes in the years after the Kyoto compliance period.

Illustrative Calculations: Methodology

Recognizing the difficulties inherent in an economic analysis, the Administration nonetheless undertook an examination of the economic impact on the U.S. economy of the Kyoto Protocol. Since no one model exists to handle all of the parameters of the Kyoto agreement, several tools had to be used to calculate the estimated costs of climate policy. First, the Administration constructed emissions baselines for all six types of greenhouse gases and 2010 business as usual levels for these gases for Annex I countries. These emissions estimates would serve as the basis for calculating the emissions reductions required to achieve the Kyoto targets. Second, we developed cost curves for reducing greenhouse gas emissions. For carbon dioxide, marginal abatement cost curves were derived from more than 60 model runs with the Second Generation Model. For other greenhouse gases, we used a bottom-up marginal abatement cost curve developed by the Interagency Analytical Team (1997). Third, we assessed several different trading scenarios based on the required emissions reductions and the constructed cost curves. Equalizing marginal costs across countries and regions generated a common permit price across the trading bloc. Fourth, we calculated the effects of the permit price on energy prices, energy consumption, GDP, investment, and consumption.

Construction of a 6 Gas Baseline and 2010 "Business as Usual" Baseline

To assess the potential economic impact of the Kyoto Protocol, it was first necessary to construct 1990/1995 baseline emissions and business as usual emissions paths that account for all six categories of greenhouse gases. While estimates of 1990 emissions and 2010 projected emissions for carbon dioxide are widely available for most Annex I countries and many large Non-Annex I countries, the Administration gathered data on the other greenhouse gases from more than 25 submitted National Communications to the Framework Convention on Climate Change, official reports of the Framework Convention, and Environmental Protection Agency and Department of Energy analyses. In some cases, we made extrapolations from one country to another based on common characteristics (e.g., GDP). These data provide the basis for our preliminary estimates until the parties to the Framework Convention provide more detailed information on historical and projected emissions of all six categories of greenhouse gases. With these baseline estimates, the Administration estimated the magnitude of the emissions reductions required of Annex I countries under the Protocol.

Carbon Dioxide Emissions

For projections of carbon dioxide, we used the business as usual projections in the Second Generation Model, with the exception of the United States, where we used the more recent Energy Information Administration (1997a) estimate of 2010 BAU for energy-based CO_2 and the Climate Action Report (1997) projection for non-energy-based CO_2. For the European Union, the Administration adjusted the Western Europe value in SGM to reflect the non-participation of Iceland, Norway, Switzerland, and Turkey in the E.U. bubble. Based on CO_2 emissions estimates from the Carbon Dioxide Information Analysis Center, we deducted 66.1 MMTCE from the Western Europe estimate to derive the E.U. 1990 baseline CO_2 emissions value. For 2010 BAU, 85 MMTCE were deducted from the Western Europe 2010 estimate.[12]

Emissions of Other Greenhouse Gases

For projections of the other five categories of greenhouse gases, we used information provided in the national communications to the Framework Convention on Climate Change. In some cases, 2010 emissions were extrapolated from projections of 2000 emissions levels. In addition, some projections in emissions were based on growth rates in comparable countries. For a country-by-country discussion of the emissions baselines derivations, refer to Appendix B.

Converting to Carbon Equivalence

In all cases where data are provided in tons of gas, or tons of carbon dioxide equivalent, the Administration converted the data to tons of carbon equivalent based on their 100-year time horizon global warming potential (Houghton et al. 1996; refer to Table 2). Some countries aggregated all HFCs into one value (and in some cases, all PFCs into one value). We constructed an HFC weight and a PFC weight based on specific HFC and PFC emissions in the United States in 1995. For HFCs, the following weight was used:

$$[2*GWP(HFC\text{-}134a) + GWP(HFC\text{-}23)]/3 = 1300$$

HFC-134a was 52% and HFC-23 was 21% of all U.S. HFC emissions in 1995 (Climate Action Report 1997). For PFCs, the following weight was used:

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[12] We assumed that these four non-E.U. European countries would experience the same emissions growth rate as the E.U. over the 1990-2010 period to calculate their 2010 emissions.

$$[2*GWP(CF_4) + GWP(C_6F_{14})]/3 = 1855$$

CF_4 was about 60% and PFC/PFPEs[13] were about 25% of all U.S. PFC emissions in 1995 (Climate Action Report 1997).

Carbon Sinks

The Kyoto Protocol specifies that removals of CO_2 by certain kinds of sinks count toward meeting emissions targets. Mechanisms are also provided for adding new categories of sinks. Very preliminary estimates suggest that incorporating the gains from carbon sinks throughout the world could substantially reduce the costs of meeting the Kyoto target, on top of the gains from trading among Annex I countries. Such gains could be substantial under business as usual and even larger after taking into account the additional effects of government policy. Government policy could, for example, provide an incentive to increase the activities qualifying as allowable sinks, like tree-planting. However, no model has yet tried to account for such additional effects. Because the quantitative uncertainty is so large, we do not yet have an estimate with which we are comfortable. But we expect that complete modeling of the Kyoto provision pertaining to sinks would have favorable effects on projected costs. For the analysis reported here, the Administration employed a conservative assumption that all countries' sinks equaled zero and that no country would implement policies to stimulate the creation of carbon sinks.

Kyoto Targets

The emissions targets for Annex I countries were from Annex B of the Kyoto Protocol. For Non-Annex I countries, the assumed emissions targets were equal to those countries' business as usual emissions levels in 2010.

Constructing Marginal Abatement Cost Functions

To construct marginal abatement cost functions for carbon dioxide, the Administration used model results from Battelle Laboratory's Second Generation Model (SGM). SGM is a computable general equilibrium model designed to provide

estimates of the economic costs of actions to reduce carbon dioxide emissions.[14] SGM models the energy sector in greater detail than other sectors, so it can provide information on the trade-offs in the consumption of different fuels under a policy to reduce carbon dioxide emissions. It also serves the purpose of evaluating the effects of international emissions trading, because it includes twelve countries and regions (see Table 3). The capacity of the SGM model to take into account international trading is an obvious virtue of this model relative to the other two models used in the Interagency Analytical Team process, both of which only modeled the economic effects of emissions reductions in the United States. The SGM, like all models used to assess economic effects, has strengths and weaknesses. Therefore, the results from this analysis should be considered illustrative. However, the results of the Stanford EMF's investigation of the implications of international trading suggest that the conclusion that effective international trading can significantly reduce costs is robust (Weyant 1997).

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[13] The Climate Action Report (1997) notes that "PFC/PFPEs are a proxy for many diverse PFCs and perfluoropolyethers (PFPEs), which are beginning to be used in solvent applications. Global warming potential and lifetime values are based upon C_6F_{14}" (p. 71).

Table 3. Countries/Regions in Second Generation Model

Annex I	**Non-Annex I**
United States	China
Western Europe	India
Former Soviet Union	Korea
Eastern Europe	Mexico
Japan	Rest of the World
Canada	
Australia	

Source: Second Generation Model

Abatement Cost Functions in Industrialized Countries

Drawing on results of more than 60 model runs from the SGM, the Administration developed country- and region-specific cost functions for carbon dioxide abatement by matching prices and emissions reductions in different model runs. For a given country or region, at a given emissions allowance price, the country/region reduces carbon emissions by a specified amount. Over a wide range of prices, the

relationship between the allowance price and emissions reductions can be traced out. This relationship depicts the approximate marginal abatement cost for the country or region. For the United States, we aggregated the cost functions for the non-carbon dioxide greenhouse gas emissions developed by the Interagency Analytical Team (1997) with the U.S. carbon dioxide cost function to generate a cost function for the entire basket of greenhouse gases. For all other countries and regions, we assumed the carbon dioxide cost function to hold for all six categories of greenhouse gases. Based on the pattern of U.S. abatement costs, this assumption for other countries would likely over-estimate the costs of abatement.

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[14] For more information about the Second Generation Model, refer to Edmonds et al. 1992.

Abatement Cost Functions in Developing Countries

The marginal abatement cost functions for developing countries only include opportunities to reduce carbon dioxide released through energy consumption. Given that numerous options for abatement of other greenhouse gases and sequestration projects in these countries exist, these functions in fact over-estimate the costs of developing country participation.

Energy Efficiency Improvement

Energy efficiency improvements over time -- defined as the rate at which the total use of energy falls relative to GDP -- are attributable to three factors: changes in energy conservation due to price changes; the effects of non-price policy measures to improve energy efficiency (such as government support of R&D); and *autonomous* increases in energy efficiency. The first factor reflects the incentive provided by higher energy prices for firms and households to reduce energy consumption through efficiency measures and thereby make the economy as a whole more energy efficient. The second factor reflects the potential influence of a wide range of non-price public policies to improve the efficiency with which energy is used in the economy. For example, measures could be undertaken to speed the rate of diffusion and adoption of technologies which can simultaneously lower energy use and household and business energy bills. Finally, energy efficiency improvements occur over time which are independent of both prices and energy policies. For example, in the United States, the gradual transition from a manufacturing economy to a less energy-intensive service economy has improved the energy efficiency of the economy. The *autonomous energy efficiency improvement factor (AEEI)*[15] reflects only the pace of

efficiency improvements that are purely autonomous and thus independent of both energy prices and energy policies.

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[15] The Autonomous Energy Efficiency Improvement should be distinguished from the annual energy efficiency improvement used by some in the literature. The annual rate includes the autonomous component as well as price-induced and non-price (continued...)

In modeling energy efficiency improvement, these three components are addressed in different ways. For the *autonomous* energy efficiency factor (AEEI), a plausible assumption is an improvement of about 1.0 percent per year. The developers of the Second Generation Model employ an AEEI of 0.96 percent per year as their default energy efficiency assumption. Similarly, the Energy Information Administration analysis (see Energy Information Administration 1997a) assumes a pace of energy efficiency improvement of 0.9 percent. In this analysis, we used the SGM default assumption concerning the autonomous energy efficiency parameter. For price-induced changes in energy efficiency, the model generates its own forecasts of changes in energy consumption that reflect the effects of greenhouse gas permit prices on energy prices.

Economists have traditionally had difficulty in modeling non-price policy-induced shifts in energy efficiency. For example, it is hard to assess the likely future pay-off from investments in energy R&D, although historical estimates of the rate of return to society from such investments are substantial. Similarly, the series of policy measures proposed by the Administration -- such as the Administration's electricity restructuring proposal, the Climate Change Technology Initiative, its voluntary sectoral initiatives, the federal sector's own energy efficiency program or other measures that could be adopted to spur the diffusion and adoption of existing technologies -- could substantially reduce the cost of mitigation and increase the amount of reductions achieved domestically. However, models like the Second Generation Model do not have the capacity to quantify these potential payoffs.

Some authorities in the field of energy policy, using an engineering approach rather than an economic paradigm, have sought to quantify the extent to which policy initiatives could spur more rapid improvements in energy efficiency. Experts at five national laboratories managed by the Department of Energy found that a third of the emissions reductions necessary to return to 1990 levels by 2010 could be achieved through the adoption of existing energy-efficiency technologies at no net resource cost. This translates into a non-price policy related efficiency contribution of 0.3% per year (Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies 1997). The National Academy of Sciences reached qualitatively similar conclusions in a 1992 report. As reflected in the Department of Energy study, if a higher rate of energy efficiency improvement were achieved, the United States could meet a correspondingly larger fraction of its commitment through domestic reductions potentially at lower permit prices.

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[15] (...continued)
policy-induced components.

Trading Scenarios

Intergas Trading

We assumed that trading occurs across all gases based on 100-year global warming potential values.

Trading Blocs

The Administration assessed three different industrialized country trading blocs.

- Annex I implies trading among all Annex I countries.
- Umbrella without Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union and Eastern European countries.
- Umbrella with Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union.

In addition, we assessed two forms of developing country participation in conjunction with the industrial country trading blocs.

- Developing countries generate emissions credits through the Clean Development Mechanism and sell them internationally. The CDM is assumed to provide 20% of emissions reductions that a country would otherwise undertake if it agreed to a target at business as usual and participated in international trading.
- Key developing countries are assumed to adopt emissions growth targets equal to their 2010 business as usual emissions level and participate in international emissions trading.

Trading across Time

This analysis assessed the permit price in 2010, the midpoint of the first commitment period. Since SGM is a computable general equilibrium model, all outputs are predicated on the full use of the economy's resources, so the analysis implicitly assumes an averaging out of business cycles, weather induced energy use fluctuations, and other short-term phenomena. This smoothing out is consistent with the effect of the five-year averaging period between 2008 and 2012. The permit price

estimates for 2010 therefore provide a reasonable representation of the average permit price over 2008-2012.

Banking

This analysis did not incorporate the banking provision in the Kyoto Protocol. To model banking behavior, it is necessary to know the emissions targets for subsequent commitment periods. Since these targets have not been established yet, any assumption about future emissions targets would be speculative.

Identifying market clearing prices for trading blocs

After developing the baselines and cost functions, we calculated the market clearing prices for the trading blocs. Market clearing prices were estimated by constructing functions for the marginal cost of abatement of greenhouse gas emissions in each trading bloc. Given the greenhouse gas emissions reductions required by the Kyoto agreement for the countries within the trading bloc, these functions allow for the identification of marginal cost of abatement, and the unique price for permits traded among the countries comprising the bloc.

Calculating the Effects on Energy Prices

Reducing greenhouse gas emissions, in particular carbon dioxide emissions, would, in effect, modestly raise energy prices. At the same time, these higher prices would have the effect of reducing energy consumption by a modest amount, as firms and households cut back on some low-value uses of energy. Tradable greenhouse gas permits would also cause some shift in the fuel mix, away from carbon-intensive fuels like coal, and toward carbon-lean and carbon-free fuels, like natural gas, nuclear, and hydropower. Households would hardly notice this fuel mix shift, however, as most of it would occur at power plants.

Summary of Assumptions of Illustrative Analysis

The following list summarizes the assumptions in the illustrative modeling analysis described in the preceding section on methodology.

- Efficient and effective domestic trading of emissions allowances.

- International trading of emissions allowances (within each of three possible blocs).
  - Efficient and effective Annex I trading.
  - Efficient and effective Umbrella trading.
  - Efficient and effective trading with developing countries that adopt emissions targets.

- Trading across all six categories of greenhouse gases.

- Autonomous energy efficiency improvement (AEEI) value of 0.96% per year.

- No banking of emissions allowances to second or later commitment periods.

- Emissions targets are expressed in terms of all six categories of greenhouse gases.

- Marginal abatement costs for carbon dioxide from SGM outputs.

- Marginal abatement costs for non-carbon dioxide greenhouse gases for U.S.

- Marginal abatement costs for non-carbon dioxide greenhouse gases for other countries assumed to be the same as the costs for carbon dioxide.

- No emissions mitigation through carbon sinks for any country included in the analysis (see p. 62).

- No emission reductions from the Administration's electricity restructuring proposal included in the analysis (see p. 64).

- No emissions reductions from the Climate Change Technology Initiative included in the analysis (see p. 64).

- No emissions reductions from industries' voluntary plans through the Administration's industry consultations included in the analysis (see p. 65).

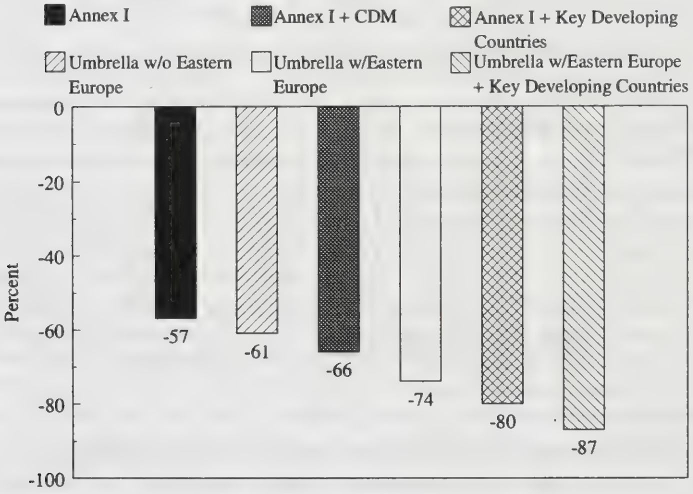
- No emissions reductions from the Federal government's energy efficiency initiative included in the analysis (see p. 66).

- No estimate of the benefits of addressing risks associated with climate change (see p. 69).

Economic Cost of the Administration's Policies to Reduce Greenhouse Gas Emissions in the Illustrative Analysis

The flexibility measures embodied in the Kyoto Protocol and the Administration's climate change approach could dramatically reduce the costs of complying with the Protocol (see Figure 19 and Table 4.) An effective international market for trading emissions permits among industrialized countries -- even without taking into account the added benefit of including key developing countries -- would potentially lower the resource cost to the United States of climate change policy by more than half relative to a scenario in which all abatement is performed domestically and would lower the price for emission permits (expressed as carbon equivalent) by nearly three

Figure 19. Percentage Reductions in Resource Costs Relative to "Domestic Only" Abatement Under Various Trading Scenarios



fourths.[16] If international trading took place only among "umbrella countries" (Annex I except for, in one scenario, the European Union, and, in another scenario, the European Union and Eastern Europe) resource costs could drop by 60-75% as compared to the domestic only cost, while permit prices could drop by 75-85% compared to a "domestic only" approach. Trading among industrialized countries alone could bring costs down into a relatively modest range.

An effective Clean Development Mechanism combined with industrialized country trading could reduce resource costs by two-thirds to four-fifths and could lower permit prices 79 - 88% compared to a domestic only approach. Finally, if some developing countries adopt growth emissions targets and participate in an effective trading system, the total resource cost to the United States could fall by 80 - 87% compared to a domestic only approach, while permit prices could sink by 88 - 93% compared to a domestic only effort.

Table 4. Permit Prices and Resource Costs Relative to "Domestic Only" Abatement of Various Trading Scenarios

Trading Scenario	Percent Reduction in Permit Price (relative to domestic only)	Percent Reduction in Resource Cost (relative to domestic only)
Annex I	72%	57%
Umbrella (with Eastern Europe)	85%	74%
Umbrella (without Eastern Europe)	75%	61%
Annex I + Key Developing Countries	88%	80%
Umbrella (with Eastern Europe) + Key Developing Countries	93%	87%
Umbrella (without Eastern Europe) + Key Developing Countries	91%	83%
Annex I + CDM	79%	66%
Umbrella (with Eastern Europe) + CDM	88%	80%
Umbrella (without Eastern Europe) + CDM	82%	71%

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[16] "Resource cost" refers to the direct cost to the U.S. economy of meeting its Kyoto target measured as the cost of emissions abated domestically plus the cost of purchases of international emissions allowances and emissions credits by U.S. firms. "Permit price" refers to the price paid for a permit to emit one metric ton of carbon equivalent. The permit price can be translated readily into an added increment for U.S. energy prices. See, for example, Table 6.

The Administration supports effective international trading and meaningful participation by key developing countries. An assessment using the SGM model that accounts for effective trading and developing country participation yields permit price estimates ranging between $14/ton and $23/ton, and resource costs between $7 billion and $12 billion/year (see Table 5). The range reflects uncertainty about the extent of Annex I participation in international trading.

Table 5. U.S. Permit Prices and Resource Costs Under the Administration's Policies

Trading Scenario	**Permit Price**	**Total Resource Cost**	**Share of 2010 GDP**
Umbrella with Eastern Europe + key developing country participation	$14/ton	$7 billion/year	0.07%
Annex I + key developing country participation	$23/ton	$12 billion/year	0.11%

The illustrative modeling analysis does not account for several key components of the Kyoto Protocol and the Administration's policies to reduce greenhouse gas emissions. These key issues include the benefits of reducing net emissions through carbon sinks, the Administration's electricity restructuring proposal, the Administration's Climate Change Technology Initiative, the Administration's sectoral consultations to encourage and support voluntary efforts by U.S. industry to undertake emissions reductions, including the provision of credit for early action, and the Administration's efforts to reduce federal energy use. Each of these factors has the potential to significantly increase the amount of reductions made domestically, while lowering the level of permit prices. The model estimates do incorporate the effects of higher energy prices on energy efficiency: results reflect annual rates of energy efficiency improvement of 1.10 - 1.21%, where 0.96% per year is the autonomous energy efficiency improvement and 0.14 - 0.25% is the price-induced energy efficiency improvement. However, any additional payoffs from the CCTI or electricity restructuring are not included in this range. The illustrative model also does not account for ancillary benefits of reducing greenhouse gas emissions, such as improved local air quality, nor does it account for the benefits of averting the risks of climate change (see pp. 66, 69). For a discussion of these cost mitigating factors, see page 62.

U.S. Energy Prices

Under the assumptions of the Administration's analysis, permit prices in the range of $14/ton to $23/ton translate into energy price increases at the household level between 3 and 5%. As Table 6 illustrates, the price increases for electricity and an array of fuels would be modest, and in several cases, the prices faced by consumers, even under the $23/ton permit price, would be lower in real terms than prices experienced today (see Appendix D for long-term energy price trends). By 2010, the increase in energy cost for the average household expected with permit prices between $14/ton and $23/ton would range between $70 and $110 annually, but this would be roughly offset by cost-savings associated with the Administration's electricity restructuring proposal.

Table 6. U.S. Energy Prices Under Permit Prices of $14/ton to $23/ton

Energy Source	**1996 Price**	**2010 BAU Price**	**2010, $14/ton**	**2010, $23/ton**
Electricity	6.9¢/Kwh	5.9¢/Kwh	6.1¢/Kwh	6.2¢/Kwh
Gasoline	$1.225/gallon	$1.259/gallon	$1.293/gallon	$1.314/gallon
Fuel Oil	$1.087/gallon	$1.092/gallon	$1.140/gallon	$1.170/gallon
Natural Gas	$4.25/mcf	$3.80/mcf	$4.00/mcf	$4.13/mcf

All data are in 1996 dollars. 1996 and 2010 BAU prices are from Energy Information Administration 1997a.

The average price of electricity is projected to fall between now and 2010 as a result of competition at the wholesale level, expected declines in coal prices, anticipated efficiency improvements, and falling capital expenditures (Energy Information Administration 1997a). Under business as usual, the average price of electricity in 2010 is projected to be 5.9¢ -- 1¢ below the average price in 1995. Permit prices of $14/ton to $23/ton would yield average electricity prices about 3 to 5% above this projected price of 5.9¢ (see Figure 20). In addition, the Administration's electricity restructuring proposal, by spurring competition at the retail level, is expected to cause electricity prices to fall an additional 10% on average. The electricity restructuring proposal with permit prices of $14/ton to $23/ton would yield electricity prices well below the business as usual projection for 2010 (see Figure 21). Refer to Appendix C for a discussion of the potential cost-savings associated with the Administration's electricity restructuring proposal.

Figure 20. Average U.S. Electricity Prices Under $14/ton to $23/ton Permit Prices, Excluding the Cost-Savings Associated with Electricity Restructuring

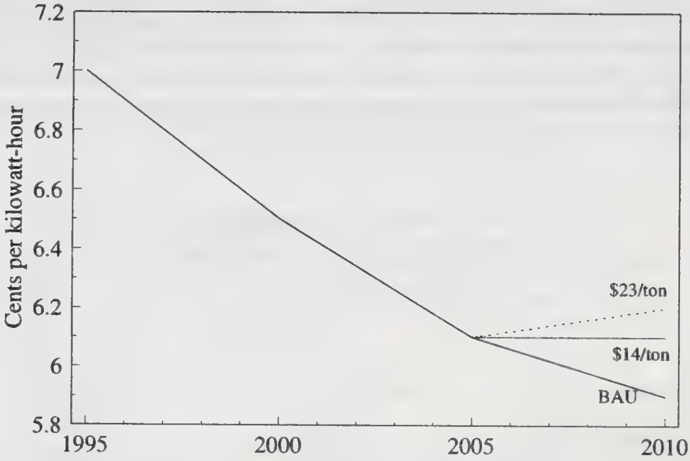
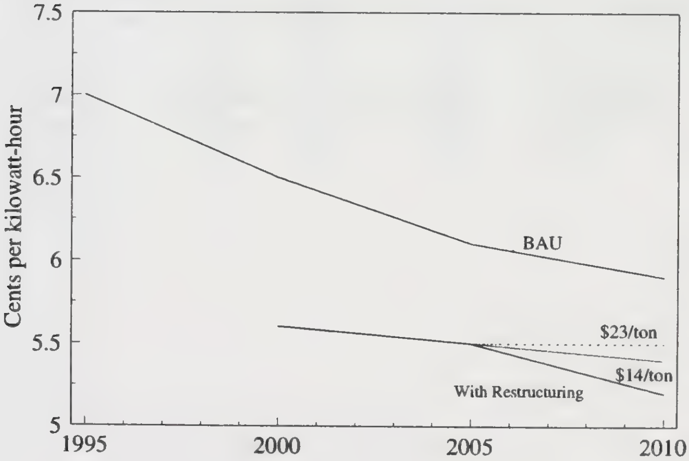
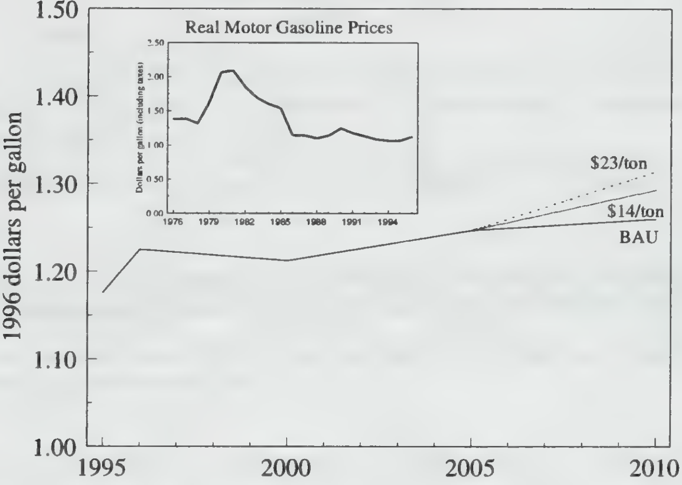


Figure 21. Average U.S. Electricity Prices Under $14/ton to $23/ton Permit Prices, Including the Cost-Savings Associated with Electricity Restructuring



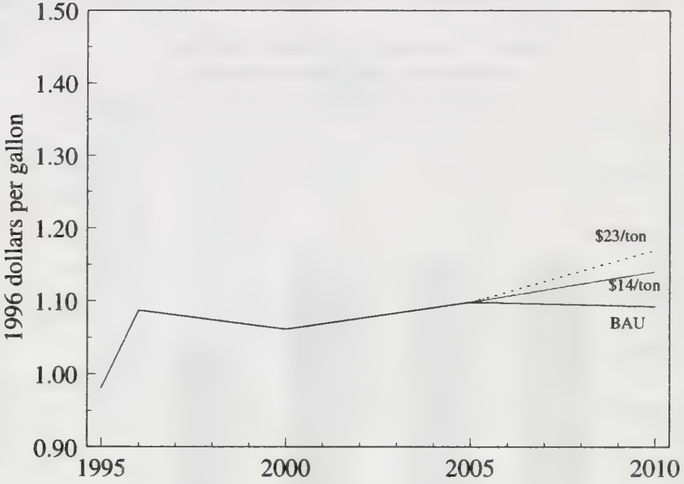
Permit prices of $14/ton to $23/ton also would be expected to increase gasoline prices by 3 to 4%, or 4 to 6¢ per gallon, relative to BAU projections for 2010 (see Figure 22). This increase, which would occur over the next decade, is smaller than the increase in gasoline prices over 1995-1996. Further, this change in gasoline price is small compared to historical changes in gas prices (see inserted figure). Over the past two decades, the average *annual* absolute change in the price of gasoline was 7.5%, about double the projected increase in gasoline prices over 12 years under the assumptions set out here.

Figure 22. Average U.S. Gasoline Prices
Under $14/ton to $23/ton Permit Prices



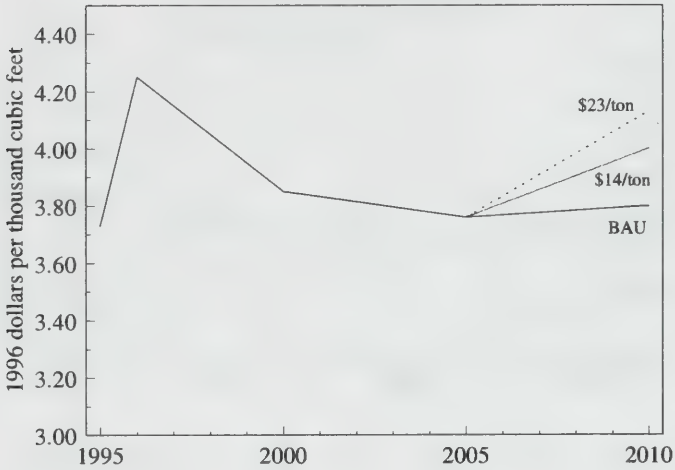
Permit prices of $14/ton to $23/ton could increase fuel oil prices by 5 to 8¢/gallon above their projected price in 2010 (see Figure 23). However, as in the case of gasoline, this increase is smaller, for example, than the jump in fuel oil prices experienced over 1995-1996.

Figure 23. Average U.S. Fuel Oil Prices Under $14/ton to $23/ton Permit Prices



Between now and 2010, delivered natural gas prices are projected to fall because of anticipated efficiency improvements and an increasingly competitive market (Energy Information Administration 1997a). While greenhouse gas permit prices of $14/ton to $23/ton would likely result in modest increases in the price of natural gas relative to baseline projections, 2010 gas prices would still be below current prices (see Figure 24). Further, the price increases under these permit prices would be smaller than the price increase over 1995-1996.

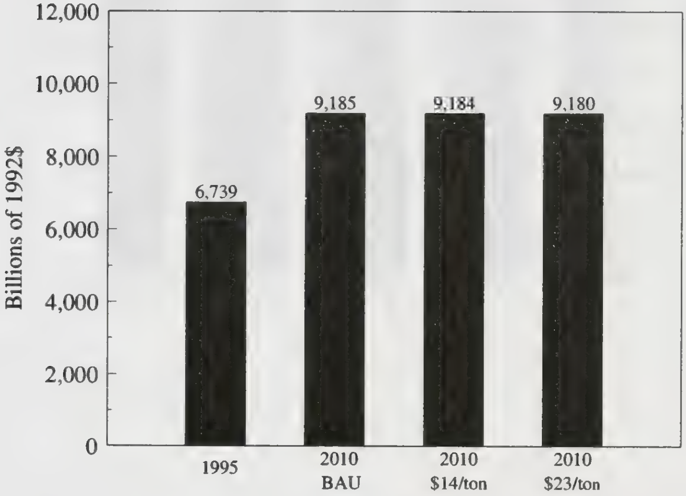
Figure 24. Average U.S. Natural Gas Prices
Under $14/ton to $23/ton Permit Prices



U.S. GDP, Investment, and Consumption

The Second Generation Model projects economic growth for the United States in its business as usual scenario through 2010 shown by the difference between the first two bars in Figure 25. Implementing climate policy through effective international trading in conjunction with meaningful developing country participation would have a negligible effect on economic output. A $14/ton permit price would result in a $1 billion (0.01 %) decline in GDP relative to business as usual. Under a $23/ton permit price, GDP would be $5 billion less in 2010 than it is projected to be otherwise.[17]

Figure 25. U.S. GDP Under $14/ton to $23/ton Permit Prices



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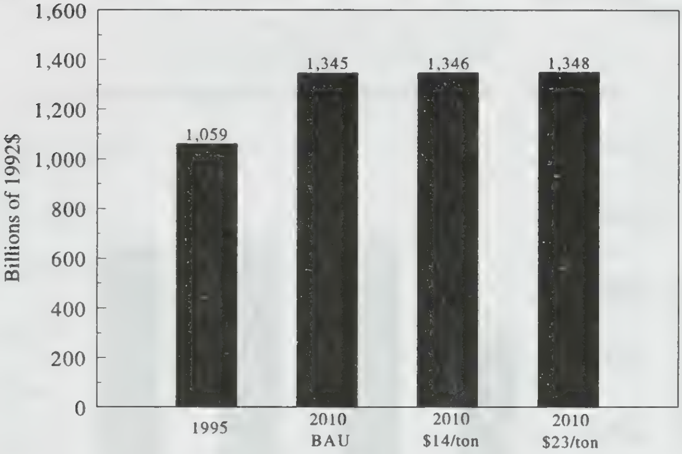
[17] Note that the SGM GDP estimate does not reflect the effects of reducing non-carbon dioxide greenhouse gas emissions.

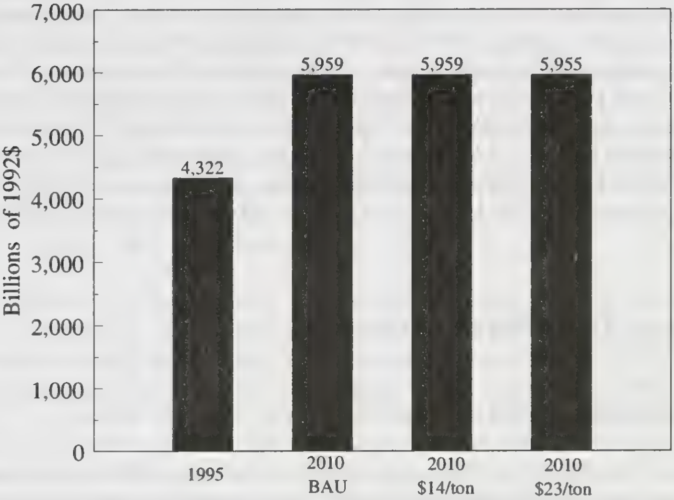
Permit prices of $14/ton to $23/ton imply a small increase in investment relative to business as usual (see Figure 26). Under a $14/ton scenario, investment would increase by $1 billion while a $23/ton permit price scenario entails a $3 billion increase in investment in 2010 relative to business as usual. This increase in investment reflects the adoption of energy efficient and carbon-lean technologies stimulated by the price of greenhouse gas permits.

Figure 26. U.S. Investment Under $14/ton to $23/ton Permit Prices



Permit prices of $14/ton to $23/ton would cause a slight shift from consumption to investment; however, this shift would be small. Under the $14/ton permit price scenario, the change in consumption would be insignificant relative to the business as usual baseline (see Figure 27). Under the $23/ton scenario, the shift would amount to a decline of about $4 billion in 2010.

Figure 27. U.S. Consumption Under $14/ton to $23/ton Permit Prices



Employment

The Second Generation Model is conditioned on the assumption that aggregate employment effects are negligible. Given the small projected energy price increases anticipated and the long lead time before any impact would occur, this assumption is appropriate. Although there may be job gains in some sectors and job losses in others, the analysis of the Kyoto Protocol with effective international trading and developing country participation suggests that there will not be a significant aggregate employment effect under permit prices of $14/ton to $23/ton. Some job loss could occur in energy-intensive sectors, although given the small predicted change in energy prices, impacts in most such sectors are apt to be modest. Further, new jobs will be created in other sectors -- such as in environmental protection technologies, energy production, and energy efficient technologies. Many of these are likely to be high-tech jobs that pay high wages. Nonetheless, as the President said in his October 1997 speech, where dislocations do occur as a result of policies to reduce greenhouse gas emissions, assistance should be provided to affected workers.

Additional Cost Mitigating Factors

Potential Benefits of Carbon Sinks

Various forestry and soil activities sequester carbon dioxide and thereby offset some emissions associated with industrial activity. Trees, other vegetation, and organic matter in soils take up carbon dioxide through photosynthesis and transform the carbon dioxide and store it in vegetative tissue. These carbon sinks can serve as opportunities to mitigate the emissions of carbon dioxide from fossil fuel combustion. For example, the Climate Action Report (1997) reported that gross anthropogenic greenhouse gas emissions in the United States in 1990 were 1,583 MMTCE. However, by including certain carbon sinks,[18] *net* greenhouse gas emissions totaled 1,458 MMTCE, or 8% lower.

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[18] Note that carbon sinks, as defined in the Climate Action Report, are different from the set of forestry activities included in the sinks definition in Article 3.3 of the Kyoto Protocol. While the estimate of sequestration from the Climate Action Report indicates that the United States has been a net sink of carbon, it should not be construed to represent the U.S. carbon sink potential under the Kyoto Protocol. Moreover, the Climate Action Report estimate of carbon sequestration excluded below-ground sinks, such as soil sinks.

The Kyoto Protocol includes opportunities to reduce net emissions through carbon sinks. Certain forestry activities -- afforestation and reforestation net of deforestation -- will be used by countries with emissions targets to meet their commitments (Kyoto Protocol, Article 3.3). The Kyoto agreement does not include carbon sinks in calculating the emissions baseline, but does allow for countries to achieve their targets by accounting for sequestration during the commitment period by these forestry activities that occur between 1990 and 2012. For countries such as the United States, where acres of tree-planting exceed acres of tree-cutting annually, this provision illustrates another opportunity where the United States can reduce net emissions at low cost. In addition, the Protocol provides the option to include additional categories of carbon sinks, like agricultural soils and other land-use change and forestry activities, based on additional technical work and negotiations (Kyoto Protocol, Article 3.4). With these carbon sinks, the United States could more easily meet its target even without additional policies to specifically encourage sink activity. However, given the ongoing negotiations to develop rules regarding carbon sinks, the Administration employed the very conservative assumption that business as usual sink activity generates no net sequestration.

Complementing the opportunities to reduce net emissions domestically through existing forestry activities, several economic analyses indicate that policies could stimulate the creation of additional carbon sinks at low costs. Stavins (1996) derived a marginal cost curve for carbon sequestration for the United States based on his analysis of land use decisions between 1935 and 1984 for a set of counties in Mississippi, Arkansas, and Louisiana. He found that more than 150 MMTCE could be sequestered at $25/ton. Adams et al. (1993) assessed several different scenarios of tree planting on agricultural land and found that about 250 MMTCE could be sequestered at approximately $25/ton.[19] Studies based on engineering/costing models indicate that even more carbon could be sequestered at low costs (Moulton and Richards 1990). While the Administration's illustrative modeling analysis did not incorporate carbon sinks, these studies clearly illustrate the potential for carbon sequestration efforts to play a significant role in meeting our emissions target. These studies provide some evidence that carbon sinks in the United States and other countries could significantly reduce the international emissions trading price and, consequently, the costs of achieving the environmental objective.

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[19] Adams et al. (1993) provide their estimate in short tons, and for purposes of comparison, we have converted this estimate to metric tons.

Potential Emissions Reductions through the Administration's Electricity Restructuring Proposal

The Administration's Comprehensive Electricity Competition Plan (CECP) is estimated to reduce greenhouse gas emissions by about 25 to 40 million metric tons of carbon equivalent per year by 2010. Although competition will lower prices, which will tend to increase consumption, it will also provide a direct profit incentive for generators to produce more electricity with less fuel and improve energy efficiency as competitive sellers seek to maximize the value of their product offerings to buyers by bundling electricity with energy efficiency and management services. In the 2010 timeframe, the net result of retail competition in the absence of additional specific provisions to encourage renewables or subsidize investments in energy efficiency is expected to be nil or a small reduction in emissions.

Specific CECP provisions that will yield additional emission reductions include a renewable portfolio standard, a public benefits fund that will support renewable energy and energy efficiency investments, "green" labeling to help consumers who value clean energy choose it, and a net metering provision encouraging the installation of small renewable systems.

Potential Emissions Reductions through the Administration's Climate Change Technology Initiative

The President's Fiscal Year 1999 budget includes the Climate Change Technology Initiative (CCTI), a $6.3 billion package of tax cuts and R&D investments intended to spur the discovery and adoption of new technologies. The goal is both to stimulate the development of new energy-saving and carbon-saving technologies and to encourage the deployment of those that exist already. Many of the components of the CCTI reflect recommendations made in a recent report by the President's Committee of Advisors on Science and Technology (PCAST 1997).[20] PCAST found that "the inadequacy of current energy R&D is especially acute in relation to the challenge of responding prudently and cost-effectively to the risk of global climatic change from society's greenhouse gas emissions.... Much of the new R&D needed to respond to this challenge would also be responsive to the other challenges" (PCAST 1997, p. i). The report concluded that investments in energy R&D would generate economic and environmental benefits, especially in the long run.

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[20] The President's Committee of Advisors on Science and Technology was established in 1993 to advise the President on matters involving science and technology. PCAST consists of distinguished representatives from industry, academia, research institutions, and other non-governmental organizations.

Building on PCAST's recommendations, the proposed CCTI package contains $3.6 billion over the next five years in tax cuts for energy-efficient purchases and renewable energy, including tax credits of $3,000 to $4,000 for consumers who purchase highly fuel efficient vehicles, a 15 percent credit (up to $2,000) for purchases of rooftop solar equipment, a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a credit up to $2,000 for purchasing energy-efficient new homes, an extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems. The package also contains $2.7 billion over the next five years in additional research and development investments -- covering the four major carbon-emitting sectors of the economy (buildings, industry, transportation, and electricity), plus carbon removal and sequestration, Federal facilities, and cross-cutting analyses and research. One example of the R&D effort is the Partnership for a New Generation of Vehicles (PNGV). PNGV is a government-industry effort to develop attractive, affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In FY99, the combined proposal for PNGV is $277 million, up from $227 million appropriated in FY98. If supported by the Congress, this effort could further improve energy efficiency and lower the cost of meeting our Kyoto target.

The Administration has not included quantitative estimates of emissions reductions associated with the Climate Change Technology Initiative in the modeling analysis. This reflects the uncertainty in calculating the payoffs from funding research and development. A fully funded CCTI would provide for additional U.S. emissions reductions and result in lower permit prices than there otherwise would be.

Potential Emissions Reductions through the Administration's Industry Consultations

Under the Administration's 1993 Climate Change Action Plan, many businesses and institutions are taking voluntary steps to improve their energy efficiency and reduce greenhouse gas emissions. According to the Climate Action Report (1997) the wide array of voluntary actions in that Plan are expected to reduce emissions by 76 MMTCE in the year 2000 and 169 MMTCE in 2010. Annual energy savings are projected to grow to $50 billion (1995 dollars) in the year 2010.

In October 1997, President Clinton called for sectoral consultations which will build on the voluntary efforts undertaken pursuant to the Climate Change Action Plan. One partnership already announced, the Partnership for Advanced Technology in Housing (PATH), sets goals for voluntary improvements in home energy use that would result in an estimated 24 MMTCE in reductions in 2010 while saving consumers $11 billion in home energy expenditures. The Administration will be seeking voluntary agreements with major energy-intensive industries and energy providers to yield further emissions reductions.

As the sectoral consultations are still at an early stage, it would be premature and difficult to incorporate emissions reductions from consultations into the illustrative modeling analysis. Based on the effectiveness of these approaches in the past, these consultations could produce a significant amount of cost-effective action in the coming decade.

Federal Energy Plan

In October, 1997, the President called for a series of steps to reduce energy use in Federal buildings, transportation fleets, and other equipment purchases, and to promote the use of renewable energy sources. As the nation's largest single energy user, the federal government spends nearly $8 billion each year for power to operate facilities, vehicles and industrial equipment, and over 90% of this energy derives from fossil fuels. Long-term savings in cost and energy use can be secured by making sure that purchases for federal facilities, transportation, and systems operations emphasize energy efficiency and that energy-intensive equipment be retrofitted wherever feasible. In addition, the federal government can expand the procurement of renewable and less carbon-intensive fuels.

Ancillary Benefits of Greenhouse Gas Emissions Reductions in the United States

Reductions in fossil fuel combustion typically lead to reductions in conventional air pollutants. These include sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter and volatile organic compounds. These reductions in emissions can have important implications for environmental quality and public health.

To estimate the ancillary benefits for the United States of the Kyoto Protocol, we employed the methods that were used for the Regulatory Impact Analysis (RIA) that the Environmental Protection Agency published in July 1997 for the revised national ambient air quality standards (NAAQS) for particulate matter and ozone. First, the DRI model was used to simulate the changes in fossil fuel combustion by region and economic sector that the Kyoto Protocol would bring about.[21] These changes in fuel consumption were then used by Pechan Associates, an EPA contractor, to estimate changes in emissions of local air pollutants.[22]

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[21] DRI/McGraw-Hill U.S. Energy Model.

Identification of the baseline from which to estimate emission reductions attributable to a carbon control strategy is complicated by the gradual transition to full attainment of the new NAAQS. In particular, states and emission sources could respond to a carbon control strategy by either replacing or maintaining NAAQS-related emission controls. Because of this uncertainty, ancillary benefits are treated as a range.

If ancillary benefits of carbon mitigation make the NAAQS-related emissions controls unnecessary, substantial costs for controlling pollution will be avoided. Reasonable estimates of the cost-savings per ton are approximately \$1,620 for NO_x and \$700 for SO_2, based on current information about the specific technologies likely to be avoided at utilities and large industrial sources. (These estimates are derived from the estimates of the incremental costs of tighter regional caps on NO_x and SO_2 emissions that were developed for the NAAQS RIA.) Given these unit values, the value of these cost-savings for sulfur dioxide is about \$360 to \$600 million per year, and for NO_x is about \$370 to \$610 million per year. Adding these together gives cost savings of about \$0.74 to \$1.2 billion per year.

If carbon mitigation partially supplements, rather than displaces, NAAQS-related controls, valuing the ancillary health and welfare benefits requires (1) an estimate of the changes in air quality, and (2) an estimate of the value in dollars of such changes. For this analysis we employed the methodologies and tools used for the NAAQS RIA of July 1997. However, we note that in this area, as others, there is substantial uncertainty surrounding the appropriate methodology. The academic literature is in flux and provides a number of possible approaches.

Since the measure of air quality responsible for most of the quantifiable benefits is the abatement of fine particulate matter, we do not quantify changes related to ozone, and concentrate instead on fine particles ($PM_{2.5}$). Reducing $PM_{2.5}$ concentrations yields a wide variety of benefits. Our analysis indicates that the reductions in $PM_{2.5}$ attributable to carbon mitigation that corresponds to the \$14/ton case would lead to between \$1.1 billion and \$5.7 billion in benefits annually. Similarly, the reductions in $PM_{2.5}$ attributable to carbon mitigation in the \$23/ton case would lead to between \$1.8 and \$9.4 billion in benefits. Although these plausible ranges appear large, they are consistent with prior estimates, e.g., in the NAAQS RIA, and reflect a variety of uncertainties in the nature of the health effects.

In this scenario, there are additional ancillary benefits in the form of avoided NAAQS-related air pollutant control costs. Specifically, for the two pollutants governed by cap and trade programs (SO_2 and NO_x), avoided control costs total about \$450 million in the \$14/ton case and about \$740 million in the \$23/ton case. Total annual ancillary benefits for this valuation approach range from about \$1.6 billion to \$6.2 billion for the \$14/ton case and from about \$2.5 billion to \$10.0 billion for the \$23/ton case.

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[22] See E.H. Pechan and Associates 1997a, b.

Thus as a conservative estimate, a quarter of the costs of the Kyoto agreement are offset by these ancillary benefits, although there is substantial uncertainty about these estimates.

It should be noted that the level of ancillary benefits from carbon mitigation increases with the extent of domestic mitigation and decreases to the extent that mitigation is based on purchasing international emissions allowances. In general the magnitude of these ancillary benefits depends on the type of regulation of air quality and emissions of local air pollutants, as well as baseline local air quality.

Greenhouse gas mitigation strategies will result in additional reductions of other air pollutant emissions, including several that have not been quantified (see Table 7). In particular, greenhouse gas mitigation strategies will result in additional reductions in heavy metals, acetaldehyde, formaldehyde, organic aromatics, polycyclic aromatic hydrocarbons (PAH), and chlorinated dioxins and furans. These substances are capable of producing a wide array of health and environmental effects, including some forms of cancer. Exposure to these substances at some concentrations can cause effects in addition to cancer; these may range from respiratory problems to reproductive and developmental effects. Further, although reductions in nitrogen and sulfur dioxide emissions were quantified in dollar terms, the estimated values exclude the mitigation of adverse impacts on agricultural and forestry yields, aquatic and terrestrial ecosystems, and recreational fishing.

Table 7. Unquantified Ancillary Emissions Benefits

Effect Category	**Effects**	**Other Possible Effects**
Human Health	Cancer Mortality Non-cancer Effects -neurological -respiratory -reproductive -hematopoietic -developmental -immunological -organ toxicity	
Ecological	Effects on: -wildlife -plants -ecosystem -biological diversity	Loss of habitat for endangered species
Welfare	Decreased recreation opportunities Decreased agricultural yield Decreased visibility	Loss of biological diversity Building deterioration

Benefits of Averting Climate Change

In conducting this analysis, the Administration has not attempted to quantify the benefits of mitigating the risks of climate change. While several economists have estimated the damages of global warming under a doubling of atmospheric concentration (Cline 1992; Fankhauser 1993; Nordhaus 1994), they all assumed an endpoint -- an atmospheric concentration, and subsequently, an increase in global temperature. However, the Kyoto Protocol only stipulates an emissions path through 2012. To calculate the benefits of averting climate change-induced damages, it is necessary to know the emissions path for many years beyond 2012. Thus while the benefits of getting started on the Kyoto path to reducing greenhouse gas emissions may be quite large over time, we cannot estimate these benefits without knowing where the path goes in the years after the Kyoto compliance period.

Cline (1992) assessed the economic damages from warming associated with two temperature increases: 2.5° C (4.5° F) and 10° C (18° F). He presented the former temperature change as the likely effect of a doubling of the atmospheric carbon dioxide concentration and the latter temperature change as the result of "very long term warming." Under the scenario where the temperature increases 4.5° F, Cline found that the annual damage to the United States would be about 1.1% of GDP, or about $89 billion in today's terms.[23] Cline's "very long term warming" scenario resulted in economic damages of about 6% of GDP.

Cline's estimates of annual economic damage of global warming take account of the following categories of impact: agriculture, forest loss, species loss, sea-level rise (including costs of constructing dikes and levees, wetlands loss, and drylands loss), electricity requirements, non-electric heating, human amenity, human life, human morbidity, migration, hurricanes, construction, leisure activities, water supply, urban infrastructure, and air pollution. Cline provides only qualitative assessments for several categories. In addition, he found that non-electric heating expenditures decline with global warming, so this is actually considered a benefit, not a cost, associated with warming.

The economic damage under a doubling of the atmospheric carbon dioxide concentration found by Cline is not significantly different in magnitude from the results of Nordhaus (1994) and Fankhauser (1993). Nordhaus estimated that a temperature increase of 5.4° F would result in annual costs of about 1% of GDP. Fankhauser found that under the same 5.4° F temperature increase the annual costs of warming would be about 1.3% of GDP for the United States, and 1.5% of GDP worldwide. However, the similarity among the aggregated estimates of these three researchers masks both the differences in their methodologies and the true uncertainty associated with long-term forecasts of the damages from given increases in global warming. Different researchers account for different categories of damages, and even within the same category, they may estimate different effects. More importantly, the estimates are all fundamentally based on extrapolations from current and past experience, and may not fully incorporate effects that will become apparent only with future experience.

International Impacts Associated with Reducing Greenhouse Gas Emissions

Just as in the United States, all Annex I countries would benefit significantly from effective implementation of the Kyoto Protocol's flexibility mechanisms. Further, Non-Annex I countries would accrue three kinds of benefits: 1) under international trade with binding targets slightly below business as usual and the CDM, they will enjoy economic gain from trade in emissions allowances; 2) reductions in carbon emissions will reduce emissions of local air pollutants; and 3) contributing to lower global greenhouse gas emissions would further reduce the risks of climate change, to which they are, in many cases, the most vulnerable and the least able to adapt.

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[23] Cline's original estimate is quoted in 1990 dollars. The figure given above translates the Cline estimate into 1997 terms by scaling it to 1997 GDP.

- **Economic benefits:** With growth targets, developing countries could enjoy substantial net gains through the international sale of emission reductions achieved at lower cost than the world price. Such participation by developing countries in international emissions allowance markets would lower the costs to industrial countries, including the United States, of meeting their Kyoto targets. In particular, costs would be lower than with trading among only Annex I countries. On a project-by-project basis, the Clean Development Mechanism would also result in net gains to developing countries and cost-savings to industrial countries. Given the anticipated difference in scale, a system including effective trading of developing countries' emissions would yield greater gains to developing countries and greater cost-savings to industrial countries than the Clean Development Mechanism.

- **Environmental benefits:** Developing country growth targets would lower global greenhouse gas emissions relative to a world with only Annex I targets. To the extent that these lower global emissions further reduce the risks of climate change, the more vulnerable developing countries would benefit. Further, reducing carbon dioxide emissions generates ancillary air quality benefits by reducing emissions of particulate matter, sulfur dioxide, and nitrogen oxides. By adopting a growth target and engaging in trading, developing countries could achieve environmental benefits not achievable by pursuing CDM alone.

Effects of Climate Change Policy on U.S. Competitiveness

Some have expressed concern that the Kyoto Protocol might adversely affect the competitive position of American industry. In general, structural changes in the economy have the effect of expanding some sectors and contracting others. But to provide some perspective on this issue, consider the following facts. First, on average, energy constitutes only 2.2 percent of total costs to U.S. industry. Second, energy prices already vary significantly across countries. For example, premium gasoline cost $1.28 per gallon in the United States in 1996, but only 8 cents per gallon in Venezuela. Similarly, gas prices were $3.71 per gallon in Switzerland and $4.41 per gallon in France (Bureau of the Census 1997). Electricity prices also vary significantly: in the U.S., for industry, they were 5 cents per kilowatt hour in 1995, a fraction of prices in Switzerland of 13 cents per kilowatt hour (OECD/IEA 1996). Yet U.S. industry did not move en masse to Venezuela, nor did Swiss industry move to the United States. Third, roughly two-thirds of all emissions are not in manufacturing at all, but in transportation and buildings, sectors which, by their very nature, are severely limited in their ability to relocate to other countries.

Evaluating how the Kyoto Protocol could affect competitiveness of a few specific manufacturing industries -- especially those that are energy-intensive, such as aluminum and chemicals -- is complex. However, the modest energy price effects associated with permit prices of $14/ton to $23/ton would likely have little impact on competitiveness.

Further, there is no reason to expect that mitigating climate change would necessarily have a negative effect on the trade balance. Indeed, the efforts to reduce greenhouse gas emissions would likely decrease oil exports to the United States, benefitting the trade balance. In short, we believe that the reason we need developing country participation is primarily because the problem is global and cost-effective solutions are essential, rather than to avoid adverse effects on competitiveness.

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APPENDICES

Appendix A

Annex I and Non-Annex I Countries

Appendix B

Construction of Non-Carbon Dioxide Emissions Baselines

Appendix C

Potential Electricity Restructuring Cost-Savings

Appendix D

Historical Trends in U.S. Energy Prices

Appendix E

Country-Specific Energy and Emissions Data

APPENDIX A: ANNEX I AND NON-ANNEX I COUNTRIES

The 1992 Framework Convention on Climate Change stipulated that, among other provisions, a non-binding emissions reduction goal for the industrialized countries of the world. These countries, including most developed countries and the economies in transition of the former Soviet bloc, are identified in the treaty as members of "Annex I". Countries not included in this list are identified as "Non-Annex I". Non-Annex I is composed primarily of developing countries, but also includes the newly industrialized countries of Asia, and two OECD members (Korea and Mexico). In general, Annex I has often been used to refer to industrial countries and Non-Annex I has been used to refer to developing countries.

Under the Kyoto Protocol, the industrialized, or developed countries, that agreed to binding emissions targets are identified as Annex B countries. The list of Annex B countries is virtually identical to the list of Annex I countries (see below).

Annex I Countries under Framework Convention

Australia
Austria
Belarus
Belgium
Bulgaria
Canada
Czechoslovakia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Japan
Latvia
Lithuania
Luxembourg
Netherlands
New Zealand
Norway
Poland
Portugal
Romania
Russian Federation
Spain
Sweden
Switzerland
Turkey
Ukraine
United Kingdom
United States

Annex B Countries under Kyoto Protocol

Australia
Austria
Belgium
Bulgaria
Canada
Croatia
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Japan
Latvia
Liechtenstein
Lithuania
Luxembourg
Monaco
Netherlands
New Zealand
Norway
Poland
Portugal
Romania
Russian Federation
Slovakia
Slovenia
Spain
Sweden
Switzerland
Ukraine
United Kingdom
United States

APPENDIX B: CONSTRUCTION OF NON-CARBON DIOXIDE EMISSIONS BASELINES

Emissions of greenhouse gases for countries were drawn from the countries' national communications to the Framework Convention on Climate Change. For some countries' emissions of greenhouse gases in some years, estimates of emissions were not provided. Details of the derivation of these emissions are provided below.

- Australia: Non-CO_2 greenhouse gases comprise 33% of all greenhouse gas emissions in 1990. These are assumed to be 25% of all greenhouse gas emissions in 2010 based on the trends projected in the United States and the European Union. The 1990/95 baseline excludes SF_6 and HFCs.

- Austria: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2000 level using the projected average annual growth rate over the 1990-2000 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Belgium: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Canada: For non-CO_2 greenhouse gases, Canada is assumed to have the same non-CO_2 emissions/total greenhouse gas emissions ratio as the United States (0.17 in 1990/95 and 0.13 in 2010). Total greenhouse gas emissions are then calculated based on historical and projected CO_2 emissions.

- Denmark: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2005 level using the projected average annual growth rate over the 2000-2005 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Eastern Europe: For non-CO_2 greenhouse gases, Eastern European countries are assumed to have the same non-CO_2 emissions/total greenhouse gas emissions ratio as the Former Soviet Union (0.25 in 1990/95 and 0.19 in 2010). Total greenhouse gas emissions are then calculated based on historical and projected carbon dioxide emissions.

- Finland: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Former Soviet Union: Non-CO_2 greenhouse gases comprise 25% of all greenhouse gas emissions in 1990. These are assumed to be 19% of all greenhouse gas emissions in 2010 based on the trends projected in the United States and the European Union. The 1990/95 baseline excludes SF_6, PFCs, and HFCs.

- France: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Germany: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2005 level using the projected average annual growth rate over the 1990-2005 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Greece: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Ireland: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Italy: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Japan: Non-CO_2 greenhouse gases comprise 4% of all greenhouse gas emissions in 1990. These are assumed to be 3% of all greenhouse gas emissions in 2010 based on the trends projected in the United States and the European Union. The 1990/95 baseline excludes SF_6, PFCs, and HFCs.

- Luxembourg: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2000 level using the projected average annual growth rate over the 1990-2000 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Portugal: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP by the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

- Spain: At the time this analysis was conducted, the United Nations had not posted a national communication for Spain on the FCCC webpage. Estimates of the methane and nitrous oxide emissions are based on the average methane/GDP(1995) and nitrous oxide/GDP(1995) ratios for the other 14 E.U. countries multiplied by Spain's 1995 GDP. Similar calculations were done for the three categories of synthetic gases, but only based on the average of emissions from the Netherlands, Sweden, and the United Kingdom.

APPENDIX C: POTENTIAL ELECTRICITY RESTRUCTURING COST-SAVINGS

The Administration's electricity restructuring proposal provides potential cost-savings in four areas: cost reduction (including fuel procurement, non-fuel operation and maintenance [O&M] expenses, and administrative and general [A&G] expenses), dispatch efficiency, improved capital utilization, and savings in capital additions. These four categories of savings are likely to reach or exceed $20 billion annually. Table C1 summarizes these potential savings.

Table C1. Summary of Restructuring Cost-Savings Potential

Source of Savings	Potential Annual Cost-Savings (billions of 1996 dollars)
Cost Reduction (Fuel, non-fuel O&M, A&G)	$24.6
Dispatch Efficiency	$0.6
Improved Capital Utilization	$0.8 to $2.6
Reduced Capital Additions	$0.3 to $3.8
TOTAL	$26.3 to $31.6

Several sources of important additional savings are not considered in this analysis.

- First, as pricing becomes more efficient, load shape adjustments from consumers on the demand side of the meter can reduce the need to add expensive new capacity that would otherwise be necessary to meet peak demands of only a few hours duration per year (e.g., on the hottest summer days). A recent study of the New York State power pool suggests that savings in that one area alone could reach $660 million annually by 2010.

- Second, our cost analysis assumes that regulators and firms would not repeat past mistakes with respect to capacity planning, choice of technology, or project management that have raised the cost of power to consumers. While regulators have undoubtedly learned from past events, future regulation is unlikely to be perfect.

- Finally, experience in other sectors suggests that competition will lead to the creation of new product combinations with greater economic value to consumers. Our estimates do not reflect this benefit at all.

Fuel Costs, Non-Fuel Operation and Maintenance (O&M) Costs, and Administrative and General (A&G) Costs

Fuel Costs, Non-Fuel O&M Costs, and A&G Costs, which together accounted for roughly $94 billion in reported utility costs in 1995, largely reflect the current operations of electric utilities.[1]

Information reported in standard industry filings suggests a wide range of cost experience across reporting units and companies. These data can provide insight into opportunities for cost reduction. Our approach here is to estimate the value of bringing the cost performance of the entire industry up to the standard already demonstrated by top industry performers -- represented in this paper as the average of the top quartile of reported performance.

Some of the differences in cost experience clearly reflect circumstances that will not change under competition. For example, coal prices differ according to the distance from low-cost coal supplies; heat rates reflect the vintage, type, scale, and operating rate of plants and pollution control requirements; and distribution costs are systematically related to the density of customers on a system. To account for such factors, we stratified the reported data along key dimensions prior to developing the quartile analysis. Stratification narrows the range of cost variation, but significant differences remain, as reported in Table C2.

Table C2. Cost-Reduction Opportunities

Category	Potential Annual Cost-Savings (billions of 1996 dollars)
Fuel Acquisition	$6.7
Heat Rates	$0.9
Non-fuel Operation and Maintenance	$11.0
Administrative and General	$6.0
TOTAL	$24.6

The reported total of $24.6 billion in cost-saving potential could either underestimate or overestimate actual cost reduction opportunities. On the underestimation side, top quartile performance under regulation may understate achievable efficiencies under competition as even the best current performers re-engineer and rethink their activities. Moreover, the lack of data for existing non-utility generators, which are widely believed to be among the most cost-effective operators, could lead to some underestimation of even the current state-of-the-art efficiencies. On the overestimation side, the stratification underlying the quartiles reported in Table C2 for fuel and O&M costs may fail to account for all sources of irreducible cost differences. Moreover, the portion of the variation in cost across plants that reflects contract cycles for fuel and other inputs could be expected to narrow over time independent of the advent of competition.

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[1] A portion of A&G costs also reflect historical operations to the extent that pension liabilities have not been funded on a current basis.

Dispatch Efficiencies

Competition likely will result in improved dispatch efficiencies. The advent of competition will shift the market from a "shared savings" paradigm to one in which the party that identifies a cost-effective trade can reap the benefits, providing dispatch efficiencies beyond those that might result from wholesale competition alone. Analyses using the Policy Office Electricity Modeling System (POEMS) suggest that dispatch efficiencies resulting from retail competition can reduce aggregate system fuel costs by approximately $600 million relative to a scenario reflecting a continued cost-of-service regime.

More Efficient Utilization of Capital

The generation, transmission, and distribution of electricity are among the most capital-intensive activities in the United States. Yet, the relatively inflexible price signals provided to consumers under traditional cost-of-service regulation have resulted in relatively poor utilization of our substantial investment in electricity-related capital. Retail competition will allow electricity markets to emulate the experience of airlines and communications providers in implementing load-sensitive pricing regimes,[2] allowing the additional use of electricity in price sensitive applications during off-peak and off-season periods.

Ideally, the gains from more efficient capital utilization would be calculated separately for each load segment in each season. Although data on the segment-specific demand responses to price variation are not available, we can use the impacts of competition on average prices to develop a rough estimate of capital utilization cost-savings. Model results and recent experience with restructuring at the state level suggest that average delivered prices in a restructured industry will be 6 to 9 mills (9 to 13 percent) lower than prices projected under continued cost-of-service regulation, depending upon what provisions are made for stranded cost recovery. Using an estimate of -0.1 to -0.2 for the price elasticity,[3] the 9 to 13 percent price drop translates into an increase of between 0.9 and 2.6 percent in electricity sales.

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[2] An example of such a pricing regime can be found in the telecommunications industry where some firms offer lower prices during off-peak times, such as 5 cents per minute calls on Sundays.

The net welfare benefit from these extra sales includes two components. First, there is additional "consumer surplus," which reflects the extent to which the value of the extra electricity to buyers exceeds its price. Second, since extra sales under load-sensitive market pricing do not increase transmission or distribution system costs or stranded costs, any transmission, distribution, or stranded cost charges on these sales are also a net welfare gain. In 1995, the national average for transmission and distribution was 2.38¢/Kwh. For a level of baseline demand of 3.25 trillion kilowatt hours, the estimated net welfare gain from more intensive capital utilization is estimated to fall between $820 million and $2.6 billion.

It is important to note again that the estimates in this section focus narrowly on the more efficient use of the baseline capital stock. These estimates do not account for the substantial cost-savings associated with more nimble pricing in curtailing peaks that often necessitate the addition of expensive new capacity.

Reduced Capital Costs at Existing Plants

Capital additions at existing plants are another area where available data suggest a considerable range of experience across utilities. However, the analysis of such additions can be quite complex. First, a considerable portion of the observed variation in the cost of capital additions per unit of capacity can result from environmental or nuclear regulatory decisions affecting specific units that would not be sensitive to the shift to a more competitive regime. Second, capital additions occur at irregularly spaced intervals, and many plants will have no significant capital additions in a particular year.

To address the issue of irregularly spaced capital additions, we focused on average capital additions over a decade rather than additions in a single year. Over the 1985 to 1995 period, reported capital additions at existing power plants averaged approximately $6.3 billion per year, with average additions of $3.1 billion at nuclear plants, $2.6 billion at coal-fired plants, and $0.6 billion at oil and gas steam plants.

For present purposes, the most interesting comparisons can be made within the set of coal plants commissioned after 1965 that were operating without scrubbers or NO_x controls at the end of the sample period, since capital additions at these plants would not reflect the costs of repowering, emissions control requirements, or nuclear regulation. Assuming that the average of the top quartile of reporting units reflects the standard of performance likely to be typical in competitive markets, annual cost-savings opportunities relative to actual reported costs for capacity additions within this relatively homogeneous subgroup of coal plants are estimated to be $274 million out of $468 million. The application of cartel analysis to the capital additions data for the stratified sample of all plants of all fuel types suggests an overall potential savings of $3.8 billion, but this is likely to be a significant overestimate for reasons outlined above. The real potential for cost-savings in capital additions likely lies in the lower portion of the range of $0.3 to $3.8 billion.

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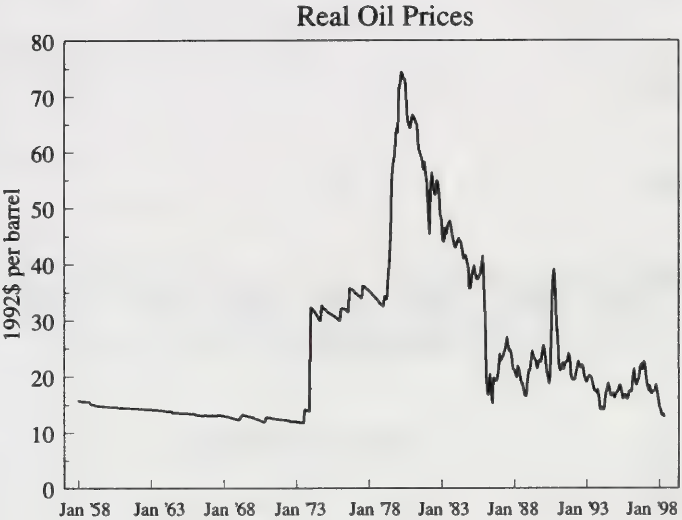
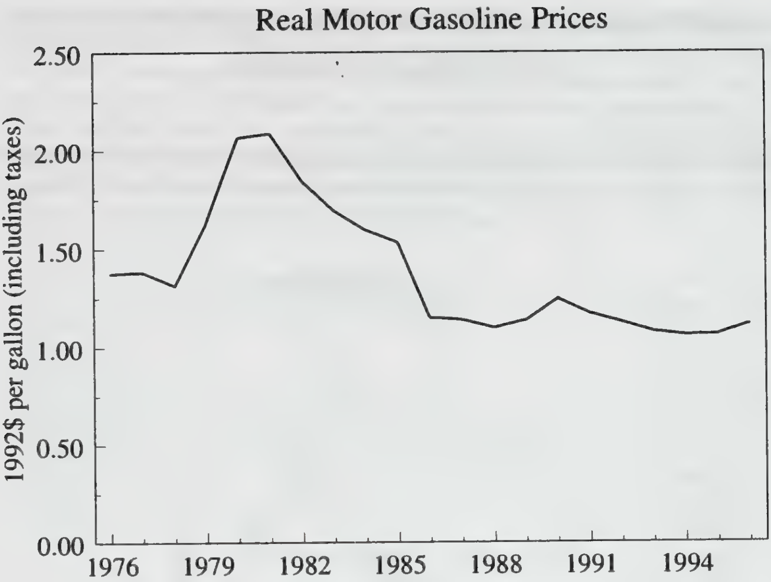
[3] This represents the percentage change in demand resulting from a 1% increase in price.

APPENDIX D. HISTORICAL TRENDS IN U.S. ENERGY PRICES

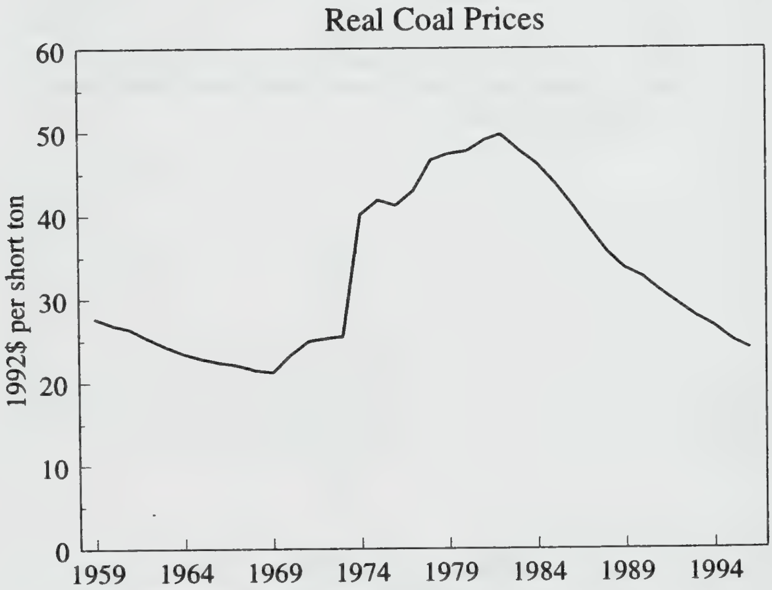
Predicted changes in real energy prices in the illustrative \$14/ton and \$23/ton permit price scenarios are smaller than the variations observed historically.



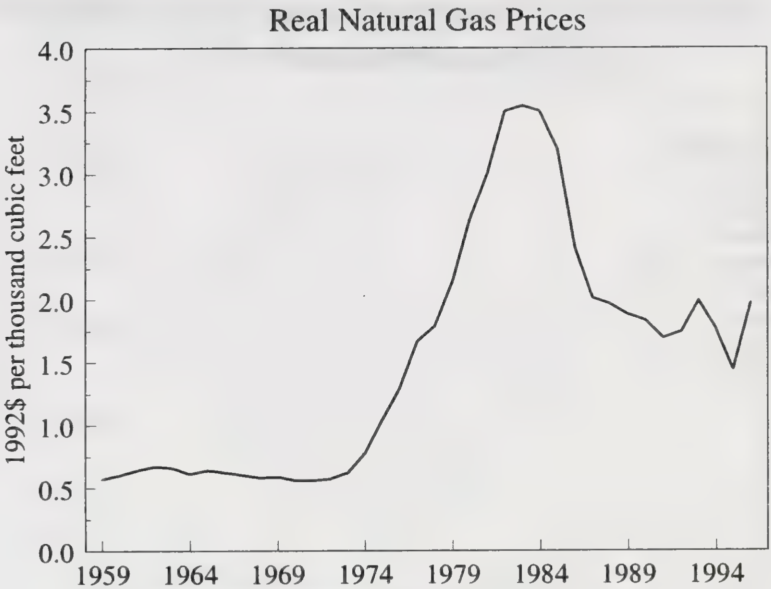
Source: Dow Jones Company.


Real Motor Gasoline Prices

Source: Energy Information Administration 1997c.


Real Coal Prices

Source: Energy Information Administration 1997c.

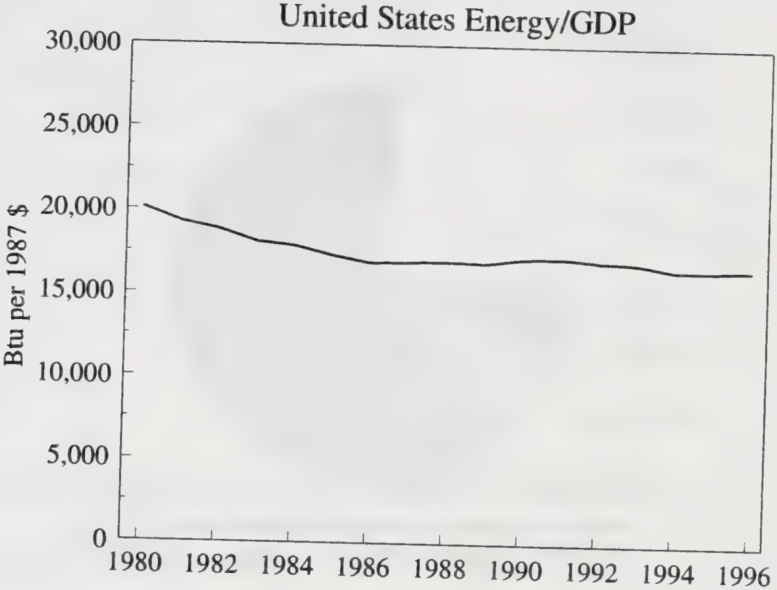


Source: Energy Information Administration 1997c.

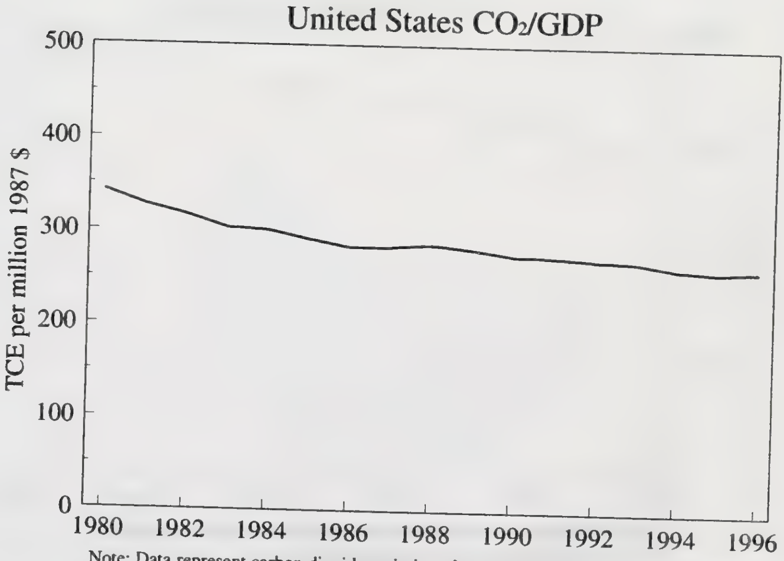
APPENDIX E: COUNTRY-SPECIFIC ENERGY AND EMISSIONS DATA

United States
Australia
Canada
China
European Union
India
Japan
Mexico

United States

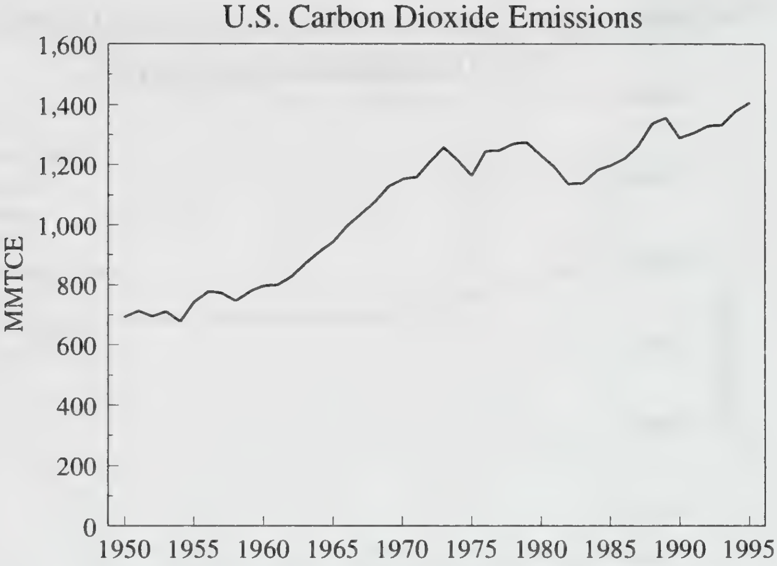


Source: Energy Information Administration 1997c.

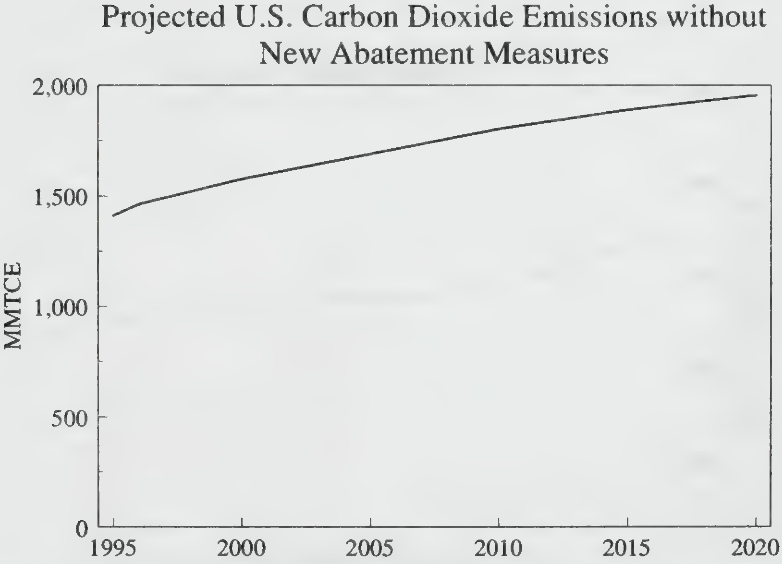


Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.

Source: Energy Information Administration 1997c.

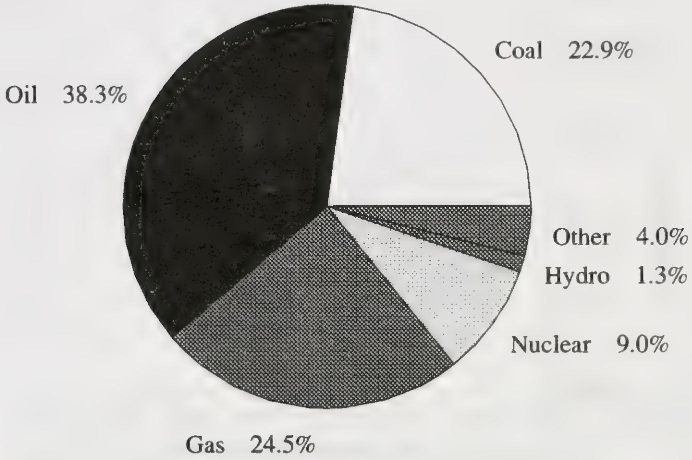


Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.



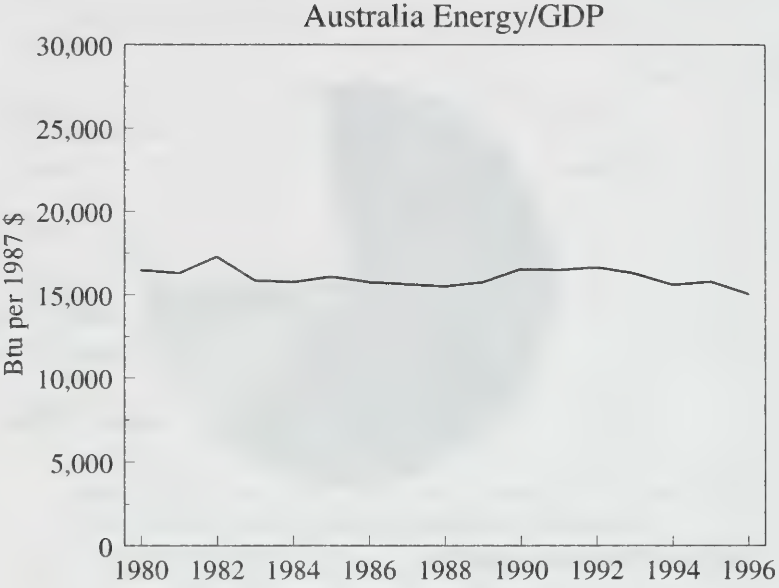
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

U.S. Total Primary Energy Supply Shares, 1995

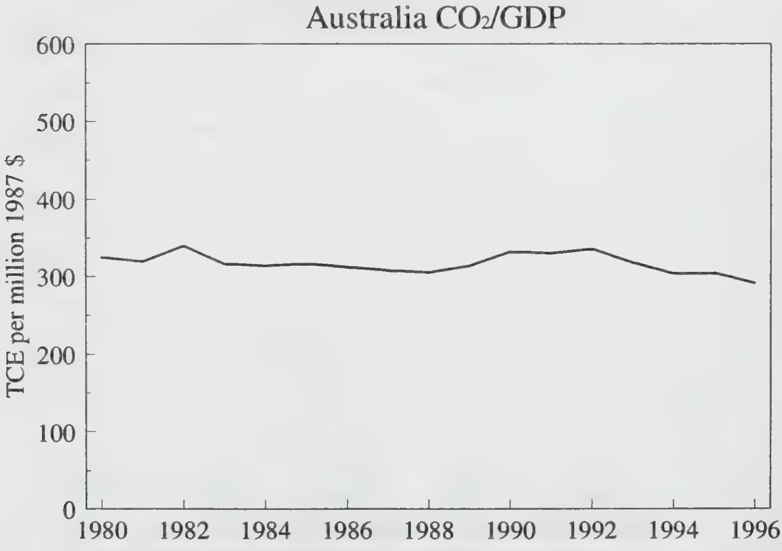


Source: International Energy Agency 1996.

Australia

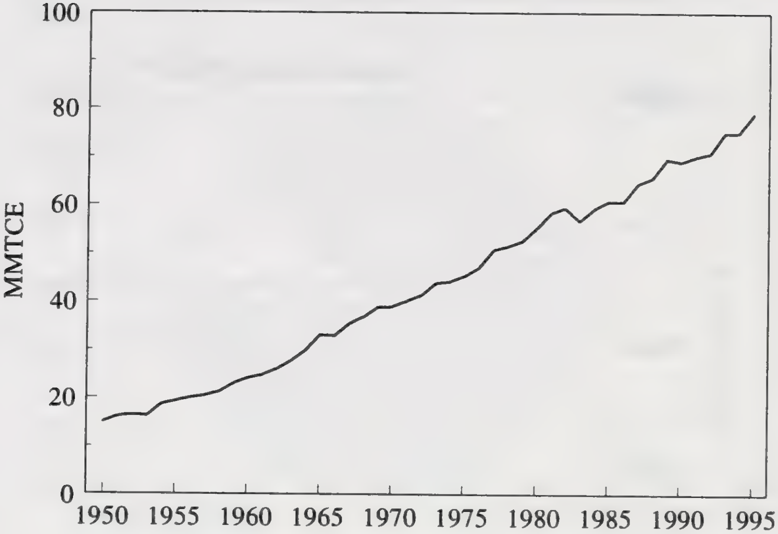


Source: Energy Information Administration 1997c.



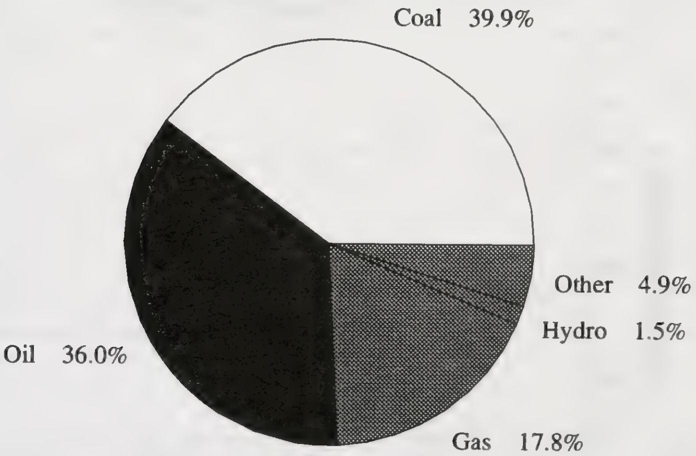
Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.
Source: Energy Information Administration 1997c.

Australia Carbon Dioxide Emissions



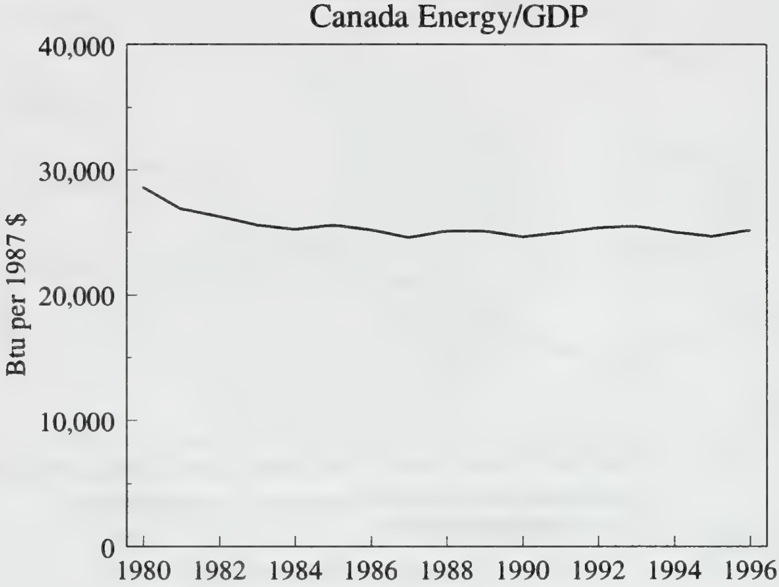
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.

Australia Total Primary Energy Supply Shares, 1995

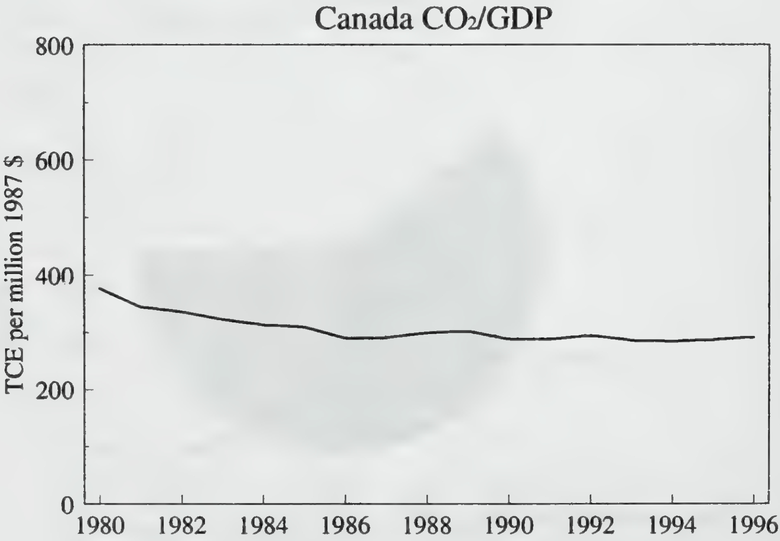


Source: International Energy Agency 1996.

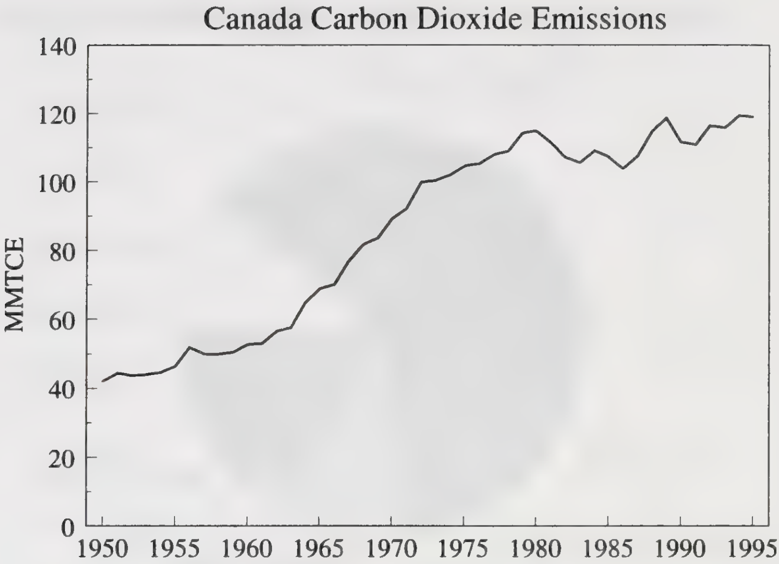
Canada



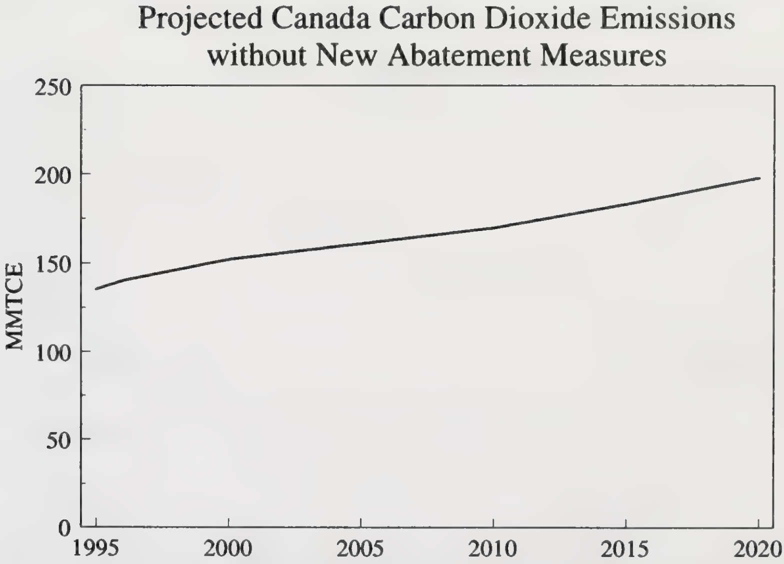
Source: Energy Information Administration 1997c.



Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.
Source: Energy Information Administration 1997c.

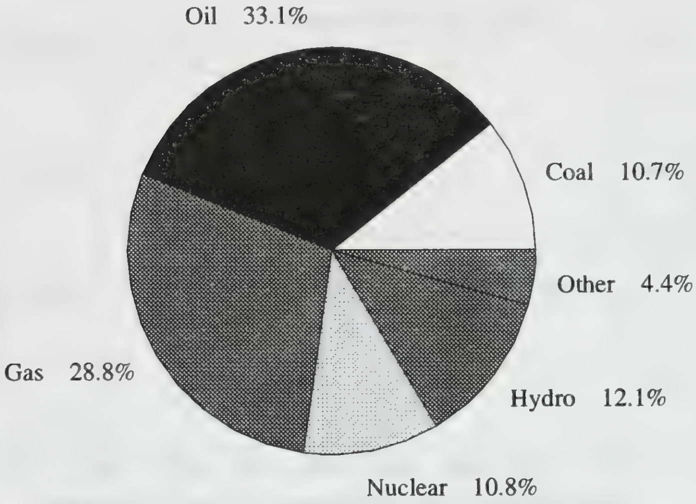


Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.



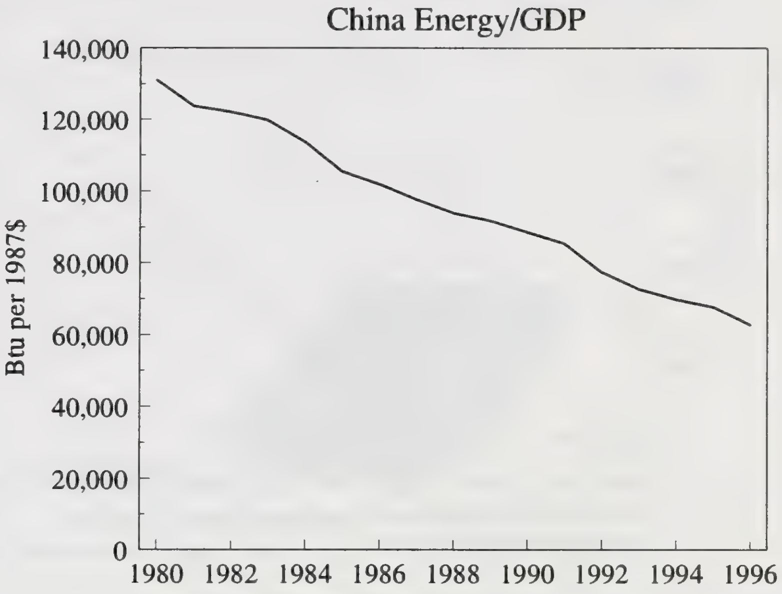
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

Canada Total Primary Energy Supply Shares, 1995

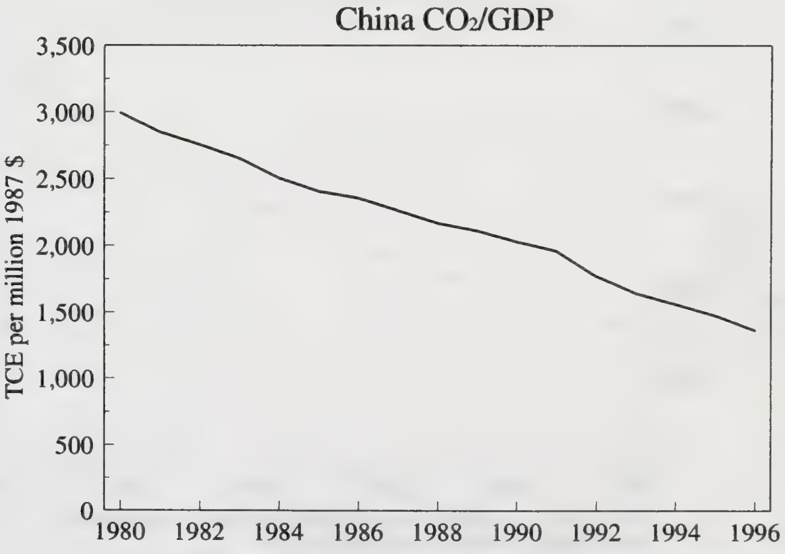


Source: International Energy Agency 1996.

China

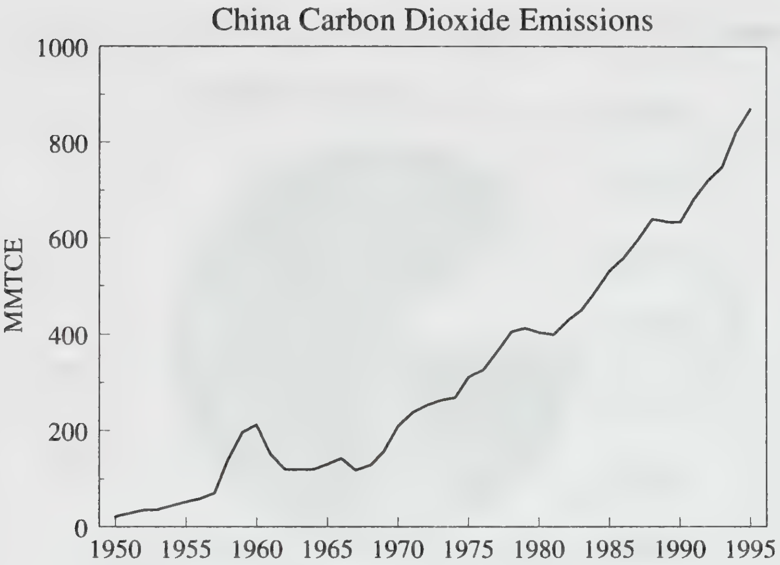


Source: Energy Information Administration 1997c.

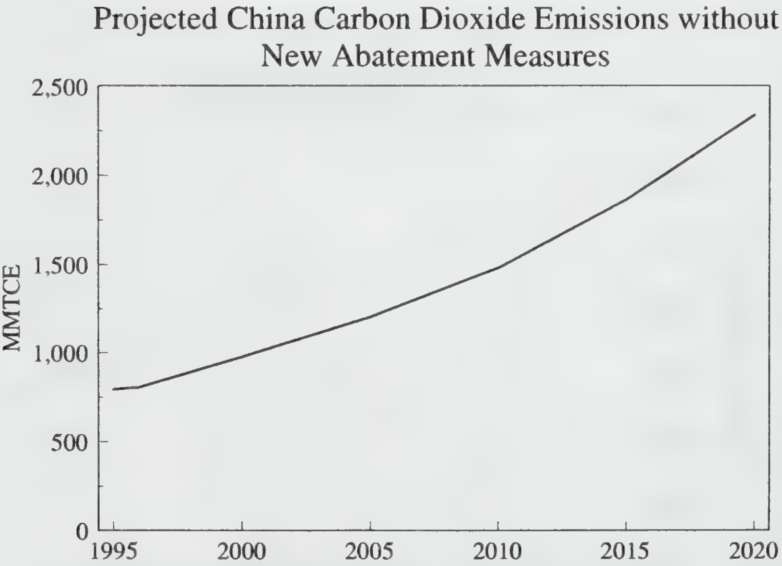


Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.

Source: Energy Information Administration 1997c.

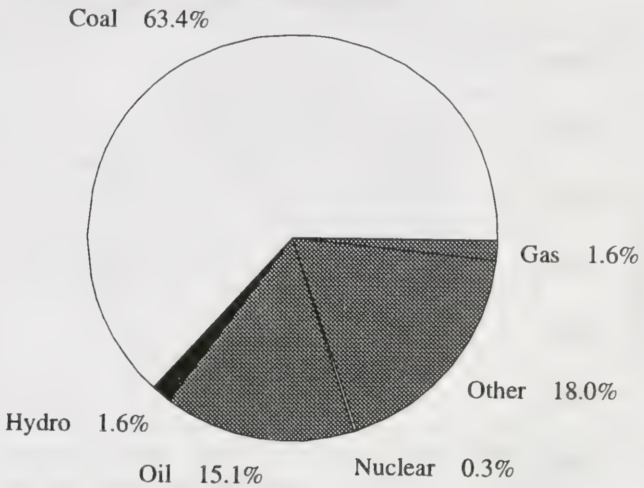


Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.



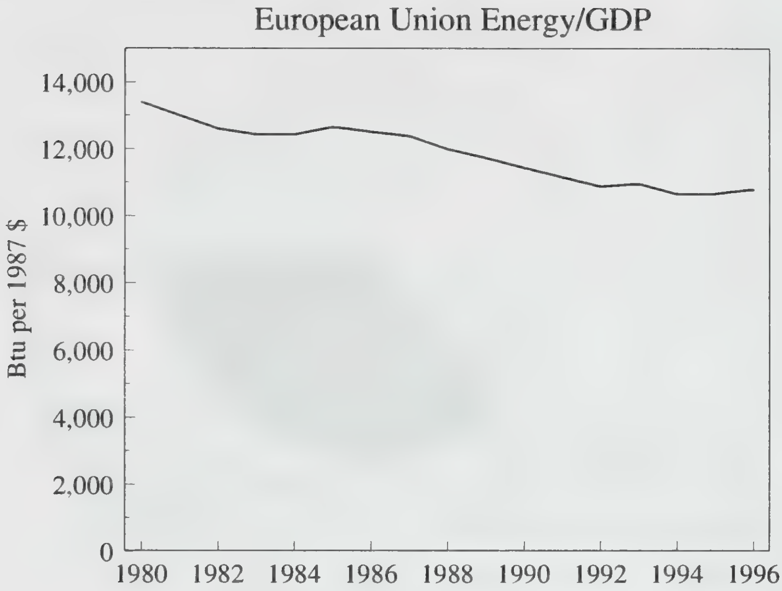
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

China Total Primary Energy Supply Shares, 1995

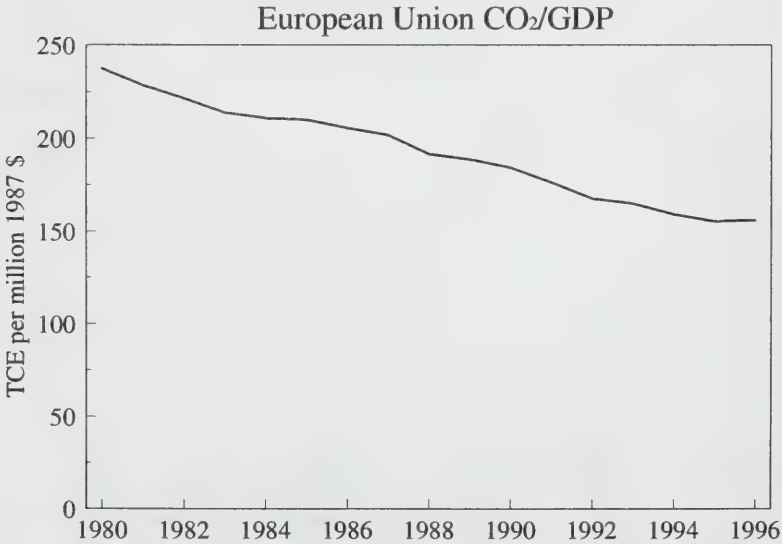


Source: International Energy Agency 1996.

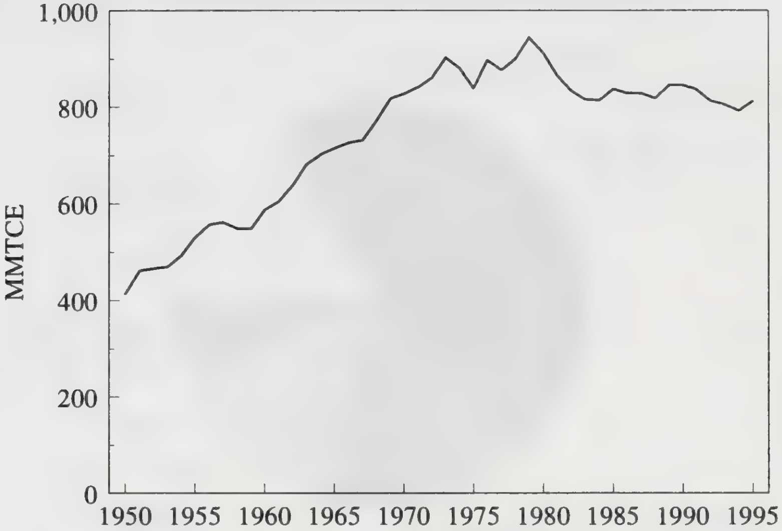
European Union



Source: Energy Information Administration 1997c.

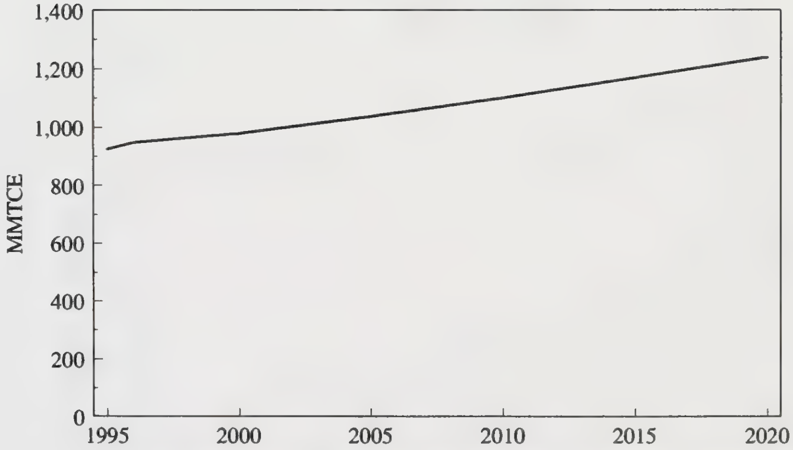


Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.
Source: Energy Information Administration 1997c.



E.U. Carbon Dioxide Emissions

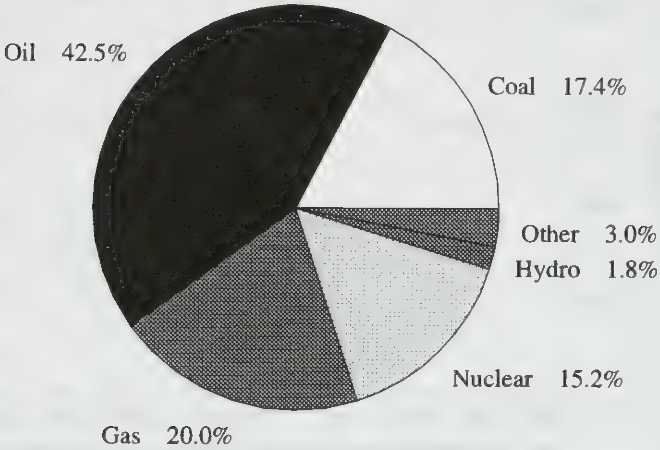
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.



Projected E.U. Carbon Emissions without New Abatement Measures

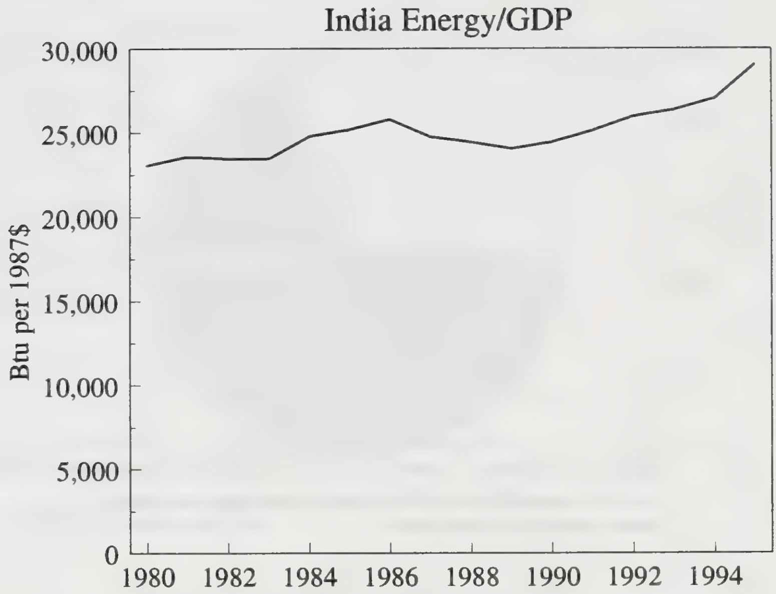
Notes: Data represent carbon dioxide emissions from fossil fuel combustion. Estimate is for Western Europe. EIA defines Western Europe to include the E.U. and Iceland, Norway, Switzerland, and Turkey.
Source: Energy Information Administration 1998a.

E.U. Total Primary Energy Supply Shares, 1995

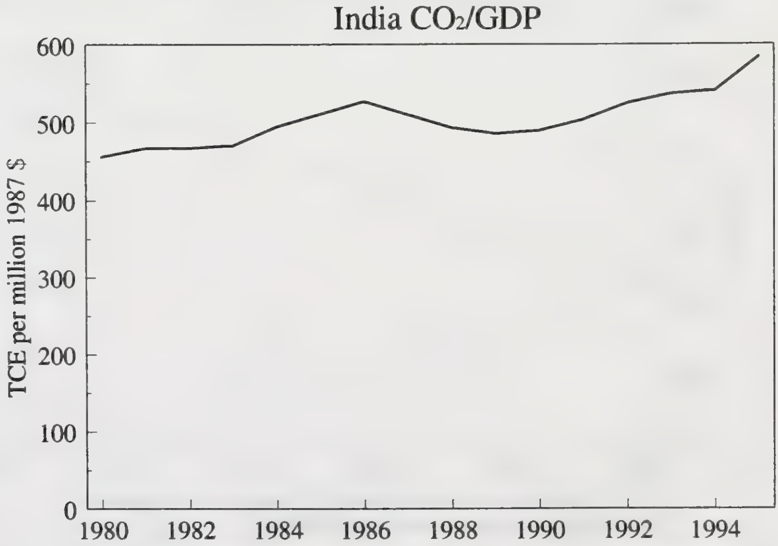


Source: International Energy Agency 1996.

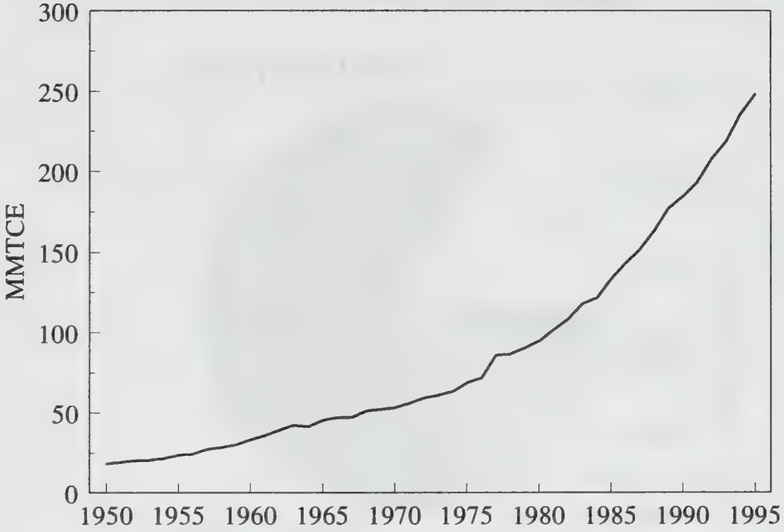
India



Source: Energy Information Administration 1997c.

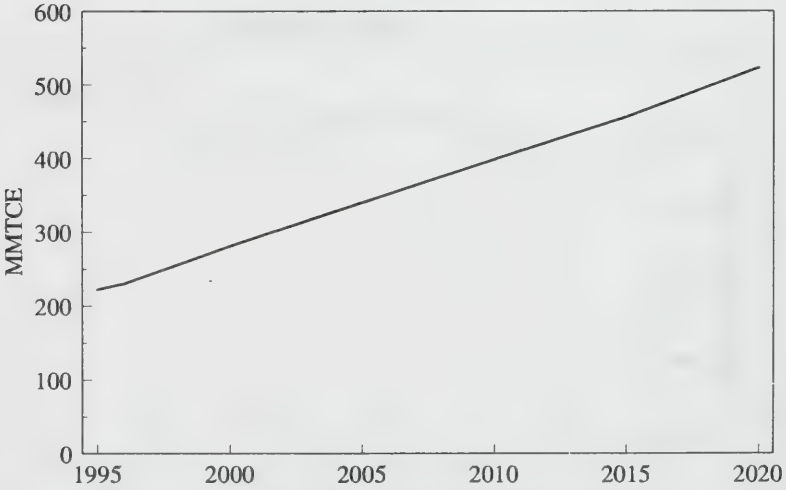


Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.
Source: Energy Information Administration 1997c.



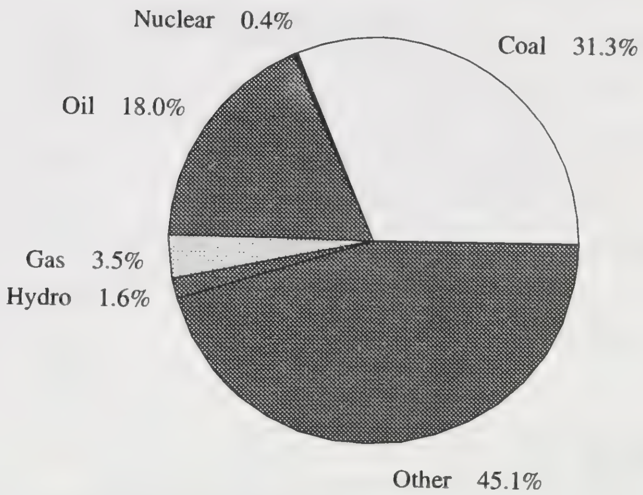
India Carbon Dioxide Emissions

Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.



Projected India Carbon Dioxide Emissions without New Abatement Measures

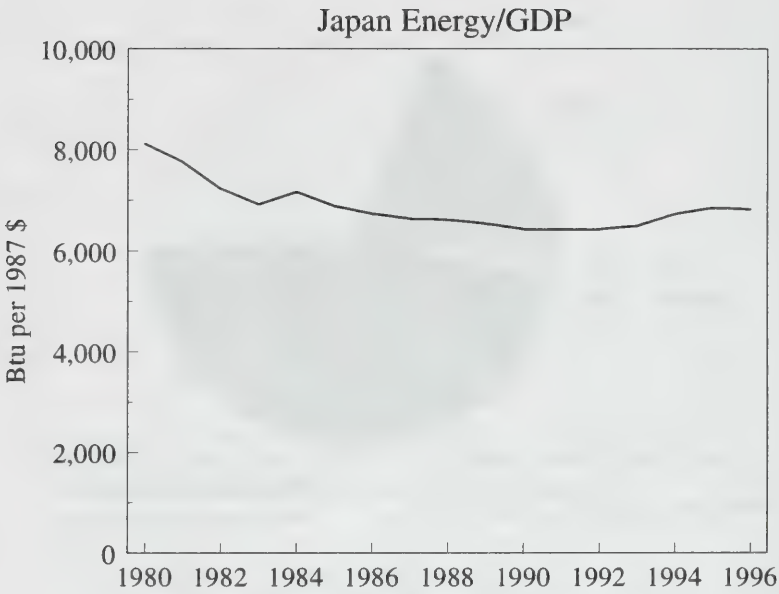
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.



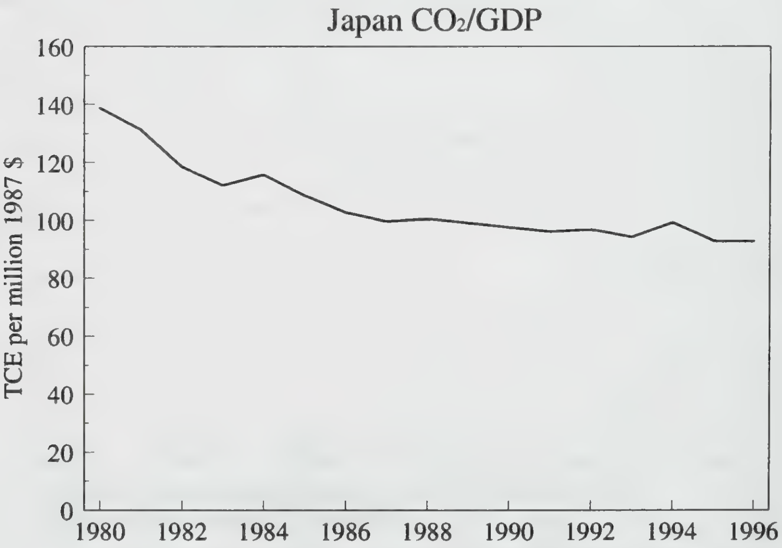
India Total Primary Energy Supply Shares, 1995

Source: International Energy Agency 1996.

Japan

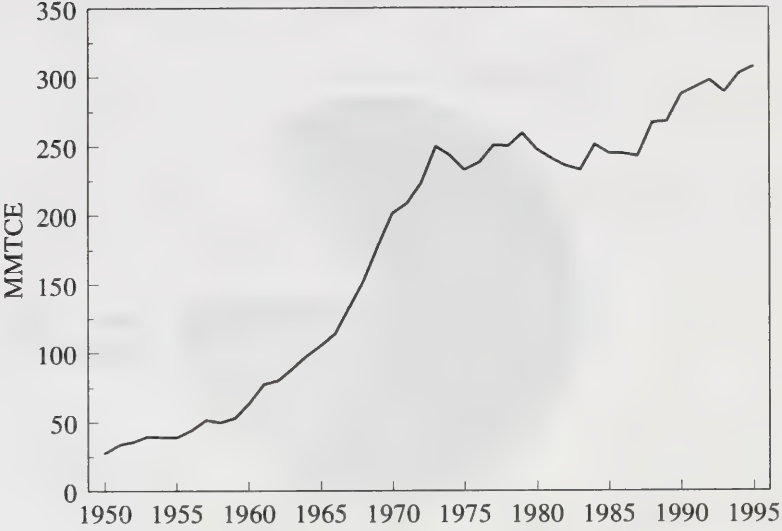


Source: Energy Information Administration 1997c.



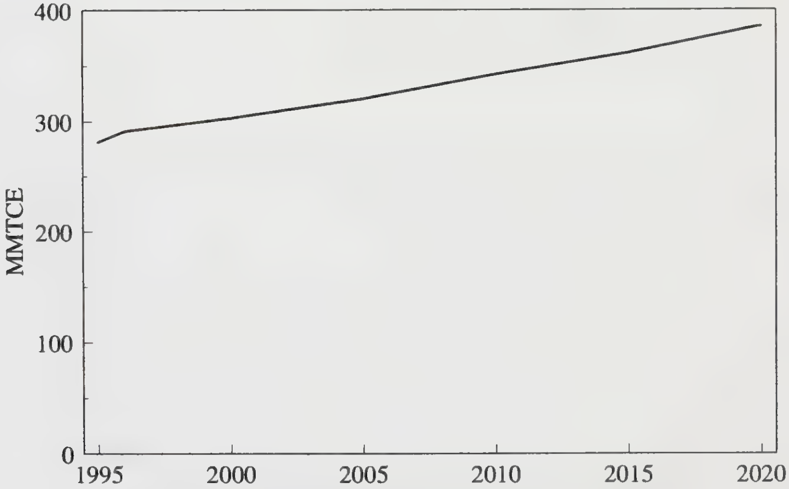
Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.
Source: Energy Information Administration 1997c.

Japan Carbon Dioxide Emissions



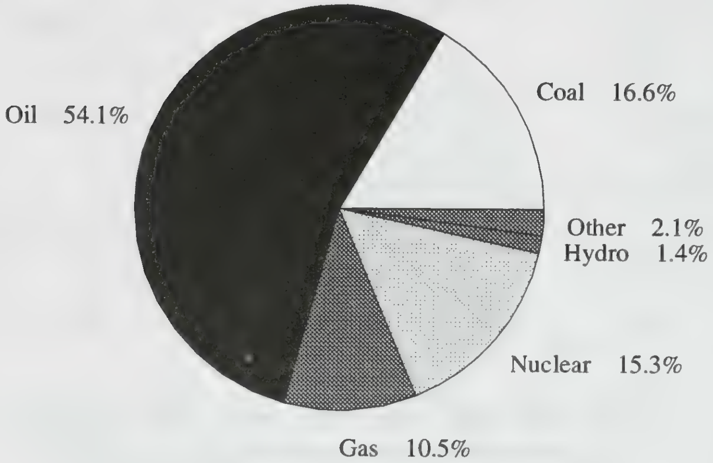
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.

Projected Japan Carbon Emissions without New Abatement Measures



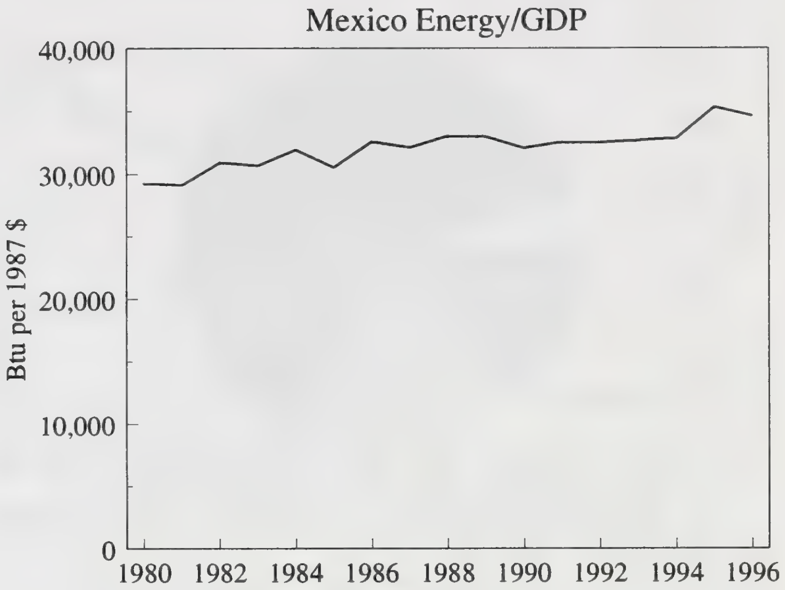
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

Japan Total Primary Energy Supply Shares, 1995

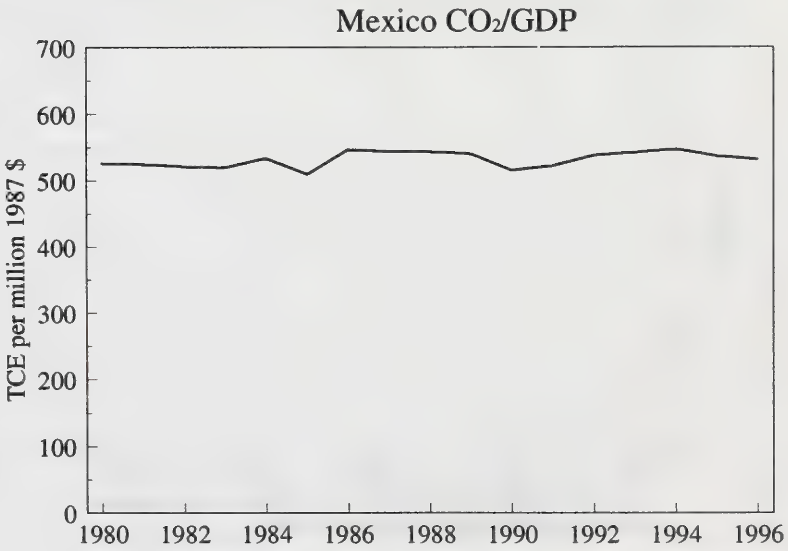


Source: International Energy Agency 1996.

Mexico

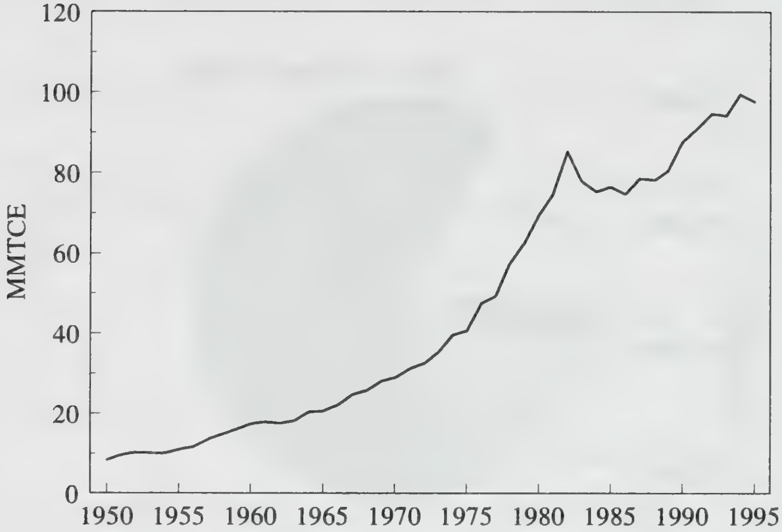


Source: Energy Information Administration 1997c.



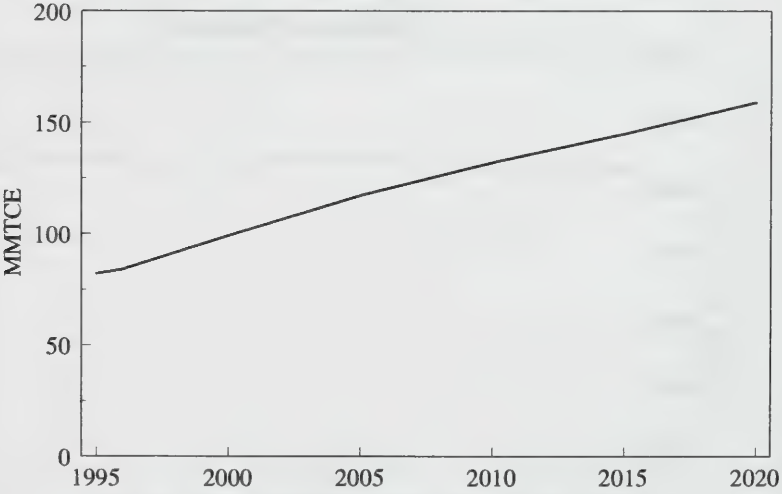
Note: Data represent carbon dioxide emissions from fossil fuel combustion measured in carbon equivalent.
Source: Energy Information Administration 1997c.

Mexico Carbon Dioxide Emissions



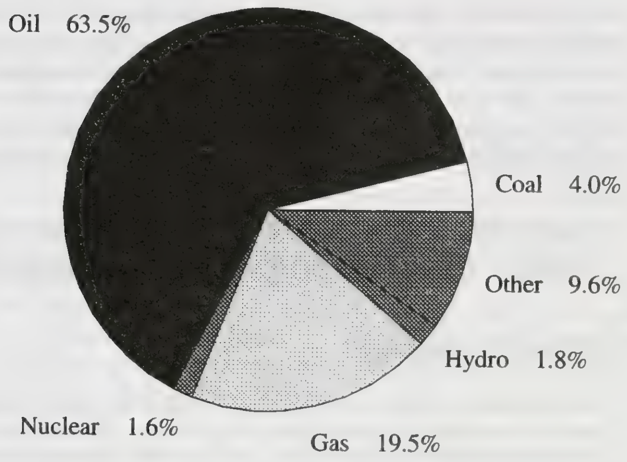
Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Marland and Boden 1998.

Projected Mexico Carbon Dioxide Emissions without New Abatement Measures



Note: Data represent carbon dioxide emissions from fossil fuel combustion.
Source: Energy Information Administration 1998a.

Mexico Total Primary Energy Supply Shares, 1995



Source: International Energy Agency 1996.

Q30.2 Please identify all of the assumptions relied upon by Dr. Yellen and indicate which require further action by the Conference of the Parties and the Congress before they are implemented.

A30.2 For a review of the assumptions and methodology for Dr. Yellen's illustrative analysis, please refer to pp. 39-50 of the AEA. Several key assumptions are made in the analysis — in particular, that developing countries engage in both emissions trading (taking on emissions limits), and in the clean development mechanism. We believe that both would be permitted under the Kyoto Protocol, and that neither requires specific action by the U.S. Congress. *(Pages 39-50 of the AEA follow.)*

ASSESSING THE COSTS AND BENEFITS OF REDUCING GREENHOUSE GAS EMISSIONS

Preliminary Assessment

The Administration employed a variety of tools to assess the various possible costs and non-climate benefits of our emissions reduction policy. Our overall conclusion is that the net costs of the Administration's policies to reduce emissions are likely to be relatively modest, assuming those reductions are undertaken in an efficient manner with effective international trading, the Clean Development Mechanism, meaningful developing country participation, and sound domestic policies. That potential small net premium, even excluding the benefits of mitigating climate change, purchases a partial insurance policy against a serious environmental threat. Further, although we think the economic benefits of mitigating climate change are subject to too many uncertainties to quantify, those benefits over time are likely to be real and large (see p. 69).

In reaching this conclusion, the Administration has drawn on the insights of a wide range of models of the energy sector and economy over the next 25 years, including but not limited to the results of the Stanford Energy Modeling Forum (Gaskins and Weyant 1993, Weyant 1997), the Intergovernmental Panel of Climate Change's review of the economic and social dimensions of climate change (Bruce et al. 1996), the work of the OECD on the economic dimensions and policy responses to global warming (OECD 1998), and the Administration's staff-level interagency analysis (Interagency Analytical Team 1997). In addition, the Administration used other tools, such as a meta-analysis (Repetto and Austin 1997), overviews of the domestic and international energy sectors (Energy Information Administration 1997a, d), simple statistics regarding energy efficiency, greenhouse gas emissions, and economic indicators from World Bank, International Energy Agency, and Energy Information Administration databases, and basic economic reasoning.

The conclusion that the impact of the Administration's policies to address the risks of climate change will be modest is not entirely dependent upon, but is fully consistent with, formal model results. The Administration continues to believe that there are limitations to relying on any single model to assess the economic impact of the Kyoto Protocol. However, model results can further inform and improve the understanding of the effects of climate change policy. To complement the economic analysis of the Administration's policy to address climate change, we have conducted

an illustrative assessment with a modified version of the Second Generation Model. The results from the SGM substantiate the conclusion that the economic effects of an efficient, effective, and global policy to address the risks of climate change will be modest.

Difficulties of an Economic Analysis of Climate Change

The difficulties associated with economic analysis of climate change fall into three broad categories. First are the uncertainties that still remain over the operational considerations of the treaty, necessitating assumptions on which the analysis is predicated. Second are the inherent limitations of available models to analyze the costs of abating emissions. Third, it is extremely difficult to quantify the long-term economic benefits of climate change mitigation, although such benefits are the motivation for the Kyoto Protocol. Economists have a difficult time projecting the behavior of the economy over the next quarter or year, let alone over the next two decades. The scale of the forecasting exercise is therefore daunting, and any specific results should be treated with substantial caution.

Uncertainties in the International Effort to Combat Climate Change

The Kyoto Protocol provides the foundation for the international effort to address climate change. However, the Protocol is still a work-in-progress. Uncertainties about the ultimate characteristics of the international climate change policy regime provide challenges in conducting an economic assessment.

For example, some of the rules pertaining to the flexibility mechanisms in the Kyoto Protocol, such as emissions trading and carbon sinks, require further delineation. These issues and others, including the role of developing countries, will be addressed in future negotiations.

More importantly, the international community has not yet negotiated agreements to limit greenhouse gas emissions beyond the 2008 to 2012 window. The emissions targets established in Kyoto provide for the first of many necessary steps to address the risks of climate change. The first step is critical because it sends a signal to the private sector regarding the value of reducing greenhouse gas emissions and it begins the task of reducing emissions relative to the business as usual path. However, subsequent steps are also necessary to address climate change risks adequately. Lack of knowledge regarding what the subsequent steps will be complicates any analysis of climate change mitigation.

Inherent Limitations of Models

In addition to these uncertainties about the details of the international effort to address climate change, there are the inherent limitations of the models used to evaluate that effort. Even within a given model, answers depend critically on the precise nature of the question asked. For example, the costs of emissions reductions depend on the extent of global participation and international trading that a treaty is assumed to feature. But in addition to the dependence of the results from a given model on the precise assumptions, different models can give different answers even when all the assumptions are specified to be the same -- a concrete illustration of the range of uncertainty surrounding the predictions of any one individual model.

Benefits of Averting Climate Change

As discussed in the risks of climate change section, it is evident that the benefits of averting climate change are potentially very large. There are several difficulties associated with monetizing the benefits of averting the risks of climate change. First, there is the uncertainty relating to the specific effects of climate change (e.g., would the planet be 2 or 6 ° F warmer in 2100, or some level within that range, without any measures to abate emissions). Second, the uncertainty over the extent that benefits should be discounted because they occur in the distant future presents challenges. Since the benefits of stemming future climate change accrue over not only decades but centuries, small changes in the discount rate can produce substantial changes in the results. Third, the benefits depend on global emissions paths after the 2008 to 2012 budget period specified in Kyoto. To calculate the benefits of averting climate change-induced damages, it is necessary to know the emissions path for many years beyond 2012. Thus while the benefits of getting started on the Kyoto path to reducing greenhouse gas emissions may be large over time, we cannot estimate these benefits without knowing where the path goes in the years after the Kyoto compliance period.

Illustrative Calculations: Methodology

Recognizing the difficulties inherent in an economic analysis, the Administration nonetheless undertook an examination of the economic impact on the U.S. economy of the Kyoto Protocol. Since no one model exists to handle all of the parameters of the Kyoto agreement, several tools had to be used to calculate the estimated costs of climate policy. First, the Administration constructed emissions baselines for all six types of greenhouse gases and 2010 business as usual levels for these gases for Annex I countries. These emissions estimates would serve as the basis for calculating the emissions reductions required to achieve the Kyoto targets. Second, we developed cost curves for reducing greenhouse gas emissions. For carbon dioxide, marginal abatement cost curves were derived from more than 60 model runs with the Second Generation Model. For other greenhouse gases, we used a bottom-up marginal abatement cost curve developed by the Interagency Analytical Team (1997). Third, we assessed several different trading scenarios based on the required emissions reductions and the constructed cost curves. Equalizing marginal costs across countries and regions generated a common permit price across the trading bloc. Fourth, we calculated the effects of the permit price on energy prices, energy consumption, GDP, investment, and consumption.

Construction of a 6 Gas Baseline and 2010 "Business as Usual" Baseline

To assess the potential economic impact of the Kyoto Protocol, it was first necessary to construct 1990/1995 baseline emissions and business as usual emissions paths that account for all six categories of greenhouse gases. While estimates of 1990 emissions and 2010 projected emissions for carbon dioxide are widely available for most Annex I countries and many large Non-Annex I countries, the Administration gathered data on the other greenhouse gases from more than 25 submitted National Communications to the Framework Convention on Climate Change, official reports of the Framework Convention, and Environmental Protection Agency and Department of Energy analyses. In some cases, we made extrapolations from one country to another based on common characteristics (e.g., GDP). These data provide the basis for our preliminary estimates until the parties to the Framework Convention provide more detailed information on historical and projected emissions of all six categories of greenhouse gases. With these baseline estimates, the Administration estimated the magnitude of the emissions reductions required of Annex I countries under the Protocol.

Carbon Dioxide Emissions

For projections of carbon dioxide, we used the business as usual projections in the Second Generation Model, with the exception of the United States, where we used the more recent Energy Information Administration (1997a) estimate of 2010 BAU for energy-based CO_2 and the Climate Action Report (1997) projection for non-energy-based CO_2. For the European Union, the Administration adjusted the Western Europe value in SGM to reflect the non-participation of Iceland, Norway, Switzerland, and Turkey in the E.U. bubble. Based on CO_2 emissions estimates from the Carbon Dioxide Information Analysis Center, we deducted 66.1 MMTCE from the Western Europe estimate to derive the E.U. 1990 baseline CO_2 emissions value. For 2010 BAU, 85 MMTCE were deducted from the Western Europe 2010 estimate.[12]

Emissions of Other Greenhouse Gases

For projections of the other five categories of greenhouse gases, we used information provided in the national communications to the Framework Convention on Climate Change. In some cases, 2010 emissions were extrapolated from projections of 2000 emissions levels. In addition, some projections in emissions were based on growth rates in comparable countries. For a country-by-country discussion of the emissions baselines derivations, refer to Appendix B.

Converting to Carbon Equivalence

In all cases where data are provided in tons of gas, or tons of carbon dioxide equivalent, the Administration converted the data to tons of carbon equivalent based on their 100-year time horizon global warming potential (Houghton et al. 1996; refer to Table 2). Some countries aggregated all HFCs into one value (and in some cases, all PFCs into one value). We constructed an HFC weight and a PFC weight based on specific HFC and PFC emissions in the United States in 1995. For HFCs, the following weight was used:

$$[2*GWP(HFC\text{-}134a) + GWP(HFC\text{-}23)]/3 = 1300$$

HFC-134a was 52% and HFC-23 was 21% of all U.S. HFC emissions in 1995 (Climate Action Report 1997). For PFCs, the following weight was used:

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[12] We assumed that these four non-E.U. European countries would experience the same emissions growth rate as the E.U. over the 1990-2010 period to calculate their 2010 emissions.

$$[2*GWP(CF_4) + GWP(C_6F_{14})]/3 = 1855$$

CF_4 was about 60% and PFC/PFPEs[13] were about 25% of all U.S. PFC emissions in 1995 (Climate Action Report 1997).

Carbon Sinks

The Kyoto Protocol specifies that removals of CO_2 by certain kinds of sinks count toward meeting emissions targets. Mechanisms are also provided for adding new categories of sinks. Very preliminary estimates suggest that incorporating the gains from carbon sinks throughout the world could substantially reduce the costs of meeting the Kyoto target, on top of the gains from trading among Annex I countries. Such gains could be substantial under business as usual and even larger after taking into account the additional effects of government policy. Government policy could, for example, provide an incentive to increase the activities qualifying as allowable sinks, like tree-planting. However, no model has yet tried to account for such additional effects. Because the quantitative uncertainty is so large, we do not yet have an estimate with which we are comfortable. But we expect that complete modeling of the Kyoto provision pertaining to sinks would have favorable effects on projected costs. For the analysis reported here, the Administration employed a conservative assumption that all countries' sinks equaled zero and that no country would implement policies to stimulate the creation of carbon sinks.

Kyoto Targets

The emissions targets for Annex I countries were from Annex B of the Kyoto Protocol. For Non-Annex I countries, the assumed emissions targets were equal to those countries' business as usual emissions levels in 2010.

Constructing Marginal Abatement Cost Functions

To construct marginal abatement cost functions for carbon dioxide, the Administration used model results from Battelle Laboratory's Second Generation Model (SGM). SGM is a computable general equilibrium model designed to provide

estimates of the economic costs of actions to reduce carbon dioxide emissions.[14] SGM models the energy sector in greater detail than other sectors, so it can provide information on the trade-offs in the consumption of different fuels under a policy to reduce carbon dioxide emissions. It also serves the purpose of evaluating the effects of international emissions trading, because it includes twelve countries and regions (see Table 3). The capacity of the SGM model to take into account international trading is an obvious virtue of this model relative to the other two models used in the Interagency Analytical Team process, both of which only modeled the economic effects of emissions reductions in the United States. The SGM, like all models used to assess economic effects, has strengths and weaknesses. Therefore, the results from this analysis should be considered illustrative. However, the results of the Stanford EMF's investigation of the implications of international trading suggest that the conclusion that effective international trading can significantly reduce costs is robust (Weyant 1997).

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[13] The Climate Action Report (1997) notes that "PFC/PFPEs are a proxy for many diverse PFCs and perfluoropolyethers (PFPEs), which are beginning to be used in solvent applications. Global warming potential and lifetime values are based upon C_6F_{14}" (p. 71).

Table 3. Countries/Regions in Second Generation Model

Annex I	**Non-Annex I**
United States	China
Western Europe	India
Former Soviet Union	Korea
Eastern Europe	Mexico
Japan	Rest of the World
Canada	
Australia	

Source: Second Generation Model

Abatement Cost Functions in Industrialized Countries

Drawing on results of more than 60 model runs from the SGM, the Administration developed country- and region-specific cost functions for carbon dioxide abatement by matching prices and emissions reductions in different model runs. For a given country or region, at a given emissions allowance price, the country/region reduces carbon emissions by a specified amount. Over a wide range of prices, the

relationship between the allowance price and emissions reductions can be traced out. This relationship depicts the approximate marginal abatement cost for the country or region. For the United States, we aggregated the cost functions for the non-carbon dioxide greenhouse gas emissions developed by the Interagency Analytical Team (1997) with the U.S. carbon dioxide cost function to generate a cost function for the entire basket of greenhouse gases. For all other countries and regions, we assumed the carbon dioxide cost function to hold for all six categories of greenhouse gases. Based on the pattern of U.S. abatement costs, this assumption for other countries would likely over-estimate the costs of abatement.

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[14] For more information about the Second Generation Model, refer to Edmonds et al. 1992.

Abatement Cost Functions in Developing Countries

The marginal abatement cost functions for developing countries only include opportunities to reduce carbon dioxide released through energy consumption. Given that numerous options for abatement of other greenhouse gases and sequestration projects in these countries exist, these functions in fact over-estimate the costs of developing country participation.

Energy Efficiency Improvement

Energy efficiency improvements over time -- defined as the rate at which the total use of energy falls relative to GDP -- are attributable to three factors: changes in energy conservation due to price changes; the effects of non-price policy measures to improve energy efficiency (such as government support of R&D); and *autonomous* increases in energy efficiency. The first factor reflects the incentive provided by higher energy prices for firms and households to reduce energy consumption through efficiency measures and thereby make the economy as a whole more energy efficient. The second factor reflects the potential influence of a wide range of non-price public policies to improve the efficiency with which energy is used in the economy. For example, measures could be undertaken to speed the rate of diffusion and adoption of technologies which can simultaneously lower energy use and household and business energy bills. Finally, energy efficiency improvements occur over time which are independent of both prices and energy policies. For example, in the United States, the gradual transition from a manufacturing economy to a less energy-intensive service economy has improved the energy efficiency of the economy. The *autonomous energy efficiency improvement factor (AEEI)*[15] reflects only the pace of

efficiency improvements that are purely autonomous and thus independent of both energy prices and energy policies.

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[15] The Autonomous Energy Efficiency Improvement should be distinguished from the annual energy efficiency improvement used by some in the literature. The annual rate includes the autonomous component as well as price-induced and non-price (continued...)

In modeling energy efficiency improvement, these three components are addressed in different ways. For the *autonomous* energy efficiency factor (AEEI), a plausible assumption is an improvement of about 1.0 percent per year. The developers of the Second Generation Model employ an AEEI of 0.96 percent per year as their default energy efficiency assumption. Similarly, the Energy Information Administration analysis (see Energy Information Administration 1997a) assumes a pace of energy efficiency improvement of 0.9 percent. In this analysis, we used the SGM default assumption concerning the autonomous energy efficiency parameter. For price-induced changes in energy efficiency, the model generates its own forecasts of changes in energy consumption that reflect the effects of greenhouse gas permit prices on energy prices.

Economists have traditionally had difficulty in modeling non-price policy-induced shifts in energy efficiency. For example, it is hard to assess the likely future pay-off from investments in energy R&D, although historical estimates of the rate of return to society from such investments are substantial. Similarly, the series of policy measures proposed by the Administration -- such as the Administration's electricity restructuring proposal, the Climate Change Technology Initiative, its voluntary sectoral initiatives, the federal sector's own energy efficiency program or other measures that could be adopted to spur the diffusion and adoption of existing technologies -- could substantially reduce the cost of mitigation and increase the amount of reductions achieved domestically. However, models like the Second Generation Model do not have the capacity to quantify these potential payoffs.

Some authorities in the field of energy policy, using an engineering approach rather than an economic paradigm, have sought to quantify the extent to which policy initiatives could spur more rapid improvements in energy efficiency. Experts at five national laboratories managed by the Department of Energy found that a third of the emissions reductions necessary to return to 1990 levels by 2010 could be achieved through the adoption of existing energy-efficiency technologies at no net resource cost. This translates into a non-price policy related efficiency contribution of 0.3% per year (Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies 1997). The National Academy of Sciences reached qualitatively similar conclusions in a 1992 report. As reflected in the Department of Energy study, if a higher rate of energy efficiency improvement were achieved, the United States could meet a correspondingly larger fraction of its commitment through domestic reductions potentially at lower permit prices.

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[15] (...continued)
policy-induced components.

Trading Scenarios

Intergas Trading

We assumed that trading occurs across all gases based on 100-year global warming potential values.

Trading Blocs

The Administration assessed three different industrialized country trading blocs.

- Annex I implies trading among all Annex I countries.
- Umbrella without Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union and Eastern European countries.
- Umbrella with Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union.

In addition, we assessed two forms of developing country participation in conjunction with the industrial country trading blocs.

- Developing countries generate emissions credits through the Clean Development Mechanism and sell them internationally. The CDM is assumed to provide 20% of emissions reductions that a country would otherwise undertake if it agreed to a target at business as usual and participated in international trading.
- Key developing countries are assumed to adopt emissions growth targets equal to their 2010 business as usual emissions level and participate in international emissions trading.

Trading across Time

This analysis assessed the permit price in 2010, the midpoint of the first commitment period. Since SGM is a computable general equilibrium model, all outputs are predicated on the full use of the economy's resources, so the analysis implicitly assumes an averaging out of business cycles, weather induced energy use fluctuations, and other short-term phenomena. This smoothing out is consistent with the effect of the five-year averaging period between 2008 and 2012. The permit price

estimates for 2010 therefore provide a reasonable representation of the average permit price over 2008-2012.

Banking

This analysis did not incorporate the banking provision in the Kyoto Protocol. To model banking behavior, it is necessary to know the emissions targets for subsequent commitment periods. Since these targets have not been established yet, any assumption about future emissions targets would be speculative.

Identifying market clearing prices for trading blocs

After developing the baselines and cost functions, we calculated the market clearing prices for the trading blocs. Market clearing prices were estimated by constructing functions for the marginal cost of abatement of greenhouse gas emissions in each trading bloc. Given the greenhouse gas emissions reductions required by the Kyoto agreement for the countries within the trading bloc, these functions allow for the identification of marginal cost of abatement, and the unique price for permits traded among the countries comprising the bloc.

Calculating the Effects on Energy Prices

Reducing greenhouse gas emissions, in particular carbon dioxide emissions, would, in effect, modestly raise energy prices. At the same time, these higher prices would have the effect of reducing energy consumption by a modest amount, as firms and households cut back on some low-value uses of energy. Tradable greenhouse gas permits would also cause some shift in the fuel mix, away from carbon-intensive fuels like coal, and toward carbon-lean and carbon-free fuels, like natural gas, nuclear, and hydropower. Households would hardly notice this fuel mix shift, however, as most of it would occur at power plants.

Summary of Assumptions of Illustrative Analysis

The following list summarizes the assumptions in the illustrative modeling analysis described in the preceding section on methodology.

- Efficient and effective domestic trading of emissions allowances.
- International trading of emissions allowances (within each of three possible blocs).
    - Efficient and effective Annex I trading.
    - Efficient and effective Umbrella trading.
    - Efficient and effective trading with developing countries that adopt emissions targets.
- Trading across all six categories of greenhouse gases.
- Autonomous energy efficiency improvement (AEEI) value of 0.96% per year.
- No banking of emissions allowances to second or later commitment periods.
- Emissions targets are expressed in terms of all six categories of greenhouse gases.
- Marginal abatement costs for carbon dioxide from SGM outputs.
- Marginal abatement costs for non-carbon dioxide greenhouse gases for U.S.
- Marginal abatement costs for non-carbon dioxide greenhouse gases for other countries assumed to be the same as the costs for carbon dioxide.
- No emissions mitigation through carbon sinks for any country included in the analysis (see p. 62).
- No emission reductions from the Administration's electricity restructuring proposal included in the analysis (see p. 64).
- No emissions reductions from the Climate Change Technology Initiative included in the analysis (see p. 64).
- No emissions reductions from industries' voluntary plans through the Administration's industry consultations included in the analysis (see p. 65).

Q30.3 What is the basis for the $20 billion figure cited by you and Dr. Yellen and the Department of Energy regarding electricity restructuring, and does it take into account the EPA proposals cited in Question 19 above on regulating carbon dioxide and other greenhouse gases?

A30.3 For a discussion of the derivation of the cost-savings associated with the Administration's electricity restructuring proposal, please refer to Appendix C in the AEA. The Comprehensive Electricity Competition Act Supporting Analysis (July 1998), DOE publication PO-0057, provides a detailed analysis of the economic benefits of the Administration's electricity competition plan. *(Appendix C of the AEA and The Comprehensive Electricity Competition Act Supporting Analysis (July 1998), DOE publication PO-0057 follow.)*

APPENDIX C: POTENTIAL ELECTRICITY RESTRUCTURING COST-SAVINGS

The Administration's electricity restructuring proposal provides potential cost-savings in four areas: cost reduction (including fuel procurement, non-fuel operation and maintenance [O&M] expenses, and administrative and general [A&G] expenses), dispatch efficiency, improved capital utilization, and savings in capital additions. These four categories of savings are likely to reach or exceed $20 billion annually. Table C1 summarizes these potential savings.

Table C1. Summary of Restructuring Cost-Savings Potential

Source of Savings	Potential Annual Cost-Savings (billions of 1996 dollars)
Cost Reduction (Fuel, non-fuel O&M, A&G)	$24.6
Dispatch Efficiency	$0.6
Improved Capital Utilization	$0.8 to $2.6
Reduced Capital Additions	$0.3 to $3.8
TOTAL	$26.3 to $31.6

Several sources of important additional savings are not considered in this analysis.

- First, as pricing becomes more efficient, load shape adjustments from consumers on the demand side of the meter can reduce the need to add expensive new capacity that would otherwise be necessary to meet peak demands of only a few hours duration per year (e.g., on the hottest summer days). A recent study of the New York State power pool suggests that savings in that one area alone could reach $660 million annually by 2010.

- Second, our cost analysis assumes that regulators and firms would not repeat past mistakes with respect to capacity planning, choice of technology, or project management that have raised the cost of power to consumers. While regulators have undoubtedly learned from past events, future regulation is unlikely to be perfect.

- Finally, experience in other sectors suggests that competition will lead to the creation of new product combinations with greater economic value to consumers. Our estimates do not reflect this benefit at all.

Fuel Costs, Non-Fuel Operation and Maintenance (O&M) Costs, and Administrative and General (A&G) Costs

Fuel Costs, Non-Fuel O&M Costs, and A&G Costs, which together accounted for roughly $94 billion in reported utility costs in 1995, largely reflect the current operations of electric utilities.[1]

Information reported in standard industry filings suggests a wide range of cost experience across reporting units and companies. These data can provide insight into opportunities for cost reduction. Our approach here is to estimate the value of bringing the cost performance of the entire industry up to the standard already demonstrated by top industry performers -- represented in this paper as the average of the top quartile of reported performance.

Some of the differences in cost experience clearly reflect circumstances that will not change under competition. For example, coal prices differ according to the distance from low-cost coal supplies; heat rates reflect the vintage, type, scale, and operating rate of plants and pollution control requirements; and distribution costs are systematically related to the density of customers on a system. To account for such factors, we stratified the reported data along key dimensions prior to developing the quartile analysis. Stratification narrows the range of cost variation, but significant differences remain, as reported in Table C2.

Table C2. Cost-Reduction Opportunities

Category	Potential Annual Cost-Savings (billions of 1996 dollars)
Fuel Acquisition	$6.7
Heat Rates	$0.9
Non-fuel Operation and Maintenance	$11.0
Administrative and General	$6.0
TOTAL	$24.6

The reported total of $24.6 billion in cost-saving potential could either underestimate or overestimate actual cost reduction opportunities. On the underestimation side, top quartile performance under regulation may understate achievable efficiencies under competition as even the best current performers re-engineer and rethink their activities. Moreover, the lack of data for existing non-utility generators, which are widely believed to be among the most cost-effective operators, could lead to some underestimation of even the current state-of-the-art efficiencies. On the overestimation side, the stratification underlying the quartiles reported in Table C2 for fuel and O&M costs may fail to account for all sources of irreducible cost differences. Moreover, the portion of the variation in cost across plants that reflects contract cycles for fuel and other inputs could be expected to narrow over time independent of the advent of competition.

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[1] A portion of A&G costs also reflect historical operations to the extent that pension liabilities have not been funded on a current basis.

Dispatch Efficiencies

Competition likely will result in improved dispatch efficiencies. The advent of competition will shift the market from a "shared savings" paradigm to one in which the party that identifies a cost-effective trade can reap the benefits, providing dispatch efficiencies beyond those that might result from wholesale competition alone. Analyses using the Policy Office Electricity Modeling System (POEMS) suggest that dispatch efficiencies resulting from retail competition can reduce aggregate system fuel costs by approximately $600 million relative to a scenario reflecting a continued cost-of-service regime.

More Efficient Utilization of Capital

The generation, transmission, and distribution of electricity are among the most capital-intensive activities in the United States. Yet, the relatively inflexible price signals provided to consumers under traditional cost-of-service regulation have resulted in relatively poor utilization of our substantial investment in electricity-related capital. Retail competition will allow electricity markets to emulate the experience of airlines and communications providers in implementing load-sensitive pricing regimes,[2] allowing the additional use of electricity in price sensitive applications during off-peak and off-season periods.

Ideally, the gains from more efficient capital utilization would be calculated separately for each load segment in each season. Although data on the segment-specific demand responses to price variation are not available, we can use the impacts of competition on average prices to develop a rough estimate of capital utilization cost-savings. Model results and recent experience with restructuring at the state level suggest that average delivered prices in a restructured industry will be 6 to 9 mills (9 to 13 percent) lower than prices projected under continued cost-of-service regulation, depending upon what provisions are made for stranded cost recovery. Using an estimate of -0.1 to -0.2 for the price elasticity,[3] the 9 to 13 percent price drop translates into an increase of between 0.9 and 2.6 percent in electricity sales.

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[2] An example of such a pricing regime can be found in the telecommunications industry where some firms offer lower prices during off-peak times, such as 5 cents per minute calls on Sundays.

The net welfare benefit from these extra sales includes two components. First, there is additional "consumer surplus," which reflects the extent to which the value of the extra electricity to buyers exceeds its price. Second, since extra sales under load-sensitive market pricing do not increase transmission or distribution system costs or stranded costs, any transmission, distribution, or stranded cost charges on these sales are also a net welfare gain. In 1995, the national average for transmission and distribution was 2.38¢/Kwh. For a level of baseline demand of 3.25 trillion kilowatt hours, the estimated net welfare gain from more intensive capital utilization is estimated to fall between $820 million and $2.6 billion.

It is important to note again that the estimates in this section focus narrowly on the more efficient use of the baseline capital stock. These estimates do not account for the substantial cost-savings associated with more nimble pricing in curtailing peaks that often necessitate the addition of expensive new capacity.

Reduced Capital Costs at Existing Plants

Capital additions at existing plants are another area where available data suggest a considerable range of experience across utilities. However, the analysis of such additions can be quite complex. First, a considerable portion of the observed variation in the cost of capital additions per unit of capacity can result from environmental or nuclear regulatory decisions affecting specific units that would not be sensitive to the shift to a more competitive regime. Second, capital additions occur at irregularly spaced intervals, and many plants will have no significant capital additions in a particular year.

To address the issue of irregularly spaced capital additions, we focused on average capital additions over a decade rather than additions in a single year. Over the 1985 to 1995 period, reported capital additions at existing power plants averaged approximately $6.3 billion per year, with average additions of $3.1 billion at nuclear plants, $2.6 billion at coal-fired plants, and $0.6 billion at oil and gas steam plants.

For present purposes, the most interesting comparisons can be made within the set of coal plants commissioned after 1965 that were operating without scrubbers or NO_x controls at the end of the sample period, since capital additions at these plants would not reflect the costs of repowering, emissions control requirements, or nuclear regulation. Assuming that the average of the top quartile of reporting units reflects the standard of performance likely to be typical in competitive markets, annual cost-savings opportunities relative to actual reported costs for capacity additions within this relatively homogeneous subgroup of coal plants are estimated to be $274 million out of $468 million. The application of cartel analysis to the capital additions data for the stratified sample of all plants of all fuel types suggests an overall potential savings of $3.8 billion, but this is likely to be a significant overestimate for reasons outlined above. The real potential for cost-savings in capital additions likely lies in the lower portion of the range of $0.3 to $3.8 billion.

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[3] This represents the percentage change in demand resulting from a 1% increase in price.

DOE/PO-0057

COMPREHENSIVE ELECTRICITY COMPETITION ACT:

SUPPORTING ANALYSIS

DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA

Office of Economic, Electricity and Natural Gas Analysis
Office of Policy and International Affairs

July 1998

SUPPORTING ANALYSIS: COMPREHENSIVE ELECTRICITY COMPETITION ACT

Section 1. Introduction and Overview

In 1996, residential, commercial, and industrial consumers spent $212 billion on electricity, making the market for electricity larger than those for telecommunications, trucking, or airline transportation services. Unlike other network industries that have been opened to competitive market forces over the past two decades, retail electricity markets have continued as regulated monopolies. However, recent advances in generating technology and the successful, if limited, participation of non-utility generators on the grid have made the characterization of electricity generation as a "natural monopoly" increasingly tenuous. Experience in wholesale electric markets and other formerly-regulated sectors of the economy suggests that increased reliance on competition could bring significant tangible benefits to all electricity consumers (residential, commercial, industrial, and government) and to the economy at large.

This paper quantifies the economic and environmental benefits of retail competition in electric markets taking into account the specific features of the Administration's Comprehensive Electricity Competition Act (CECA).

Comprehensive Electricity Competition Act: Overview of Benefits

The Comprehensive Electricity Competition Act was formulated to obtain the economic benefits of competition in a manner that is fair to all Americans and improves the environmental performance of the electricity industry. The Act: (1) encourages States to implement retail competition, (2) protects consumers by facilitating competitive markets, (3) assures access to and reliability of the transmission system, (4) promotes and preserves public benefits, including renewable energy and energy-efficiency, and (5) amends existing federal statutes to clarify federal and state authority.

The expected economic benefits of the Administration's legislative proposal fall into three main categories. First, competition will provide strong economic incentives to raise productivity through more efficient use of resources. Second, increased competition will make it worthwhile for electricity sellers to pursue more nimble pricing practices, which in turn will enable power producers to make more intensive use of their substantial investment in generation capacity. Third, and perhaps most significantly, increased competition will call forth a wide range of innovative products and services that will add value and better meet customer needs. All three categories of benefits identified above represent real efficiencies expected from competition, not a simple redistribution of existing financial flows that benefit one set of electricity interests at the expense of another. It is the real efficiencies from restructuring -- increased productivity, better use of resources, new products and services -- that will provide sustained long-run net benefits to U.S. electricity consumers.

The expected environmental benefits of the Administration's legislative proposal result from environment-friendly aspects of competition augmented by specific provisions that directly benefit the environment. Increased competition spurred by this proposed legislation will itself strengthen incentives to use fuel more efficiently at both existing and new generating plants thereby cutting emissions, costs, and fuel use. Additional emissions reductions will be provided to the extent that competitive sellers attract or retain customers by offering energy-efficiency and management services or "green power" from renewable sources in order to add value and distinguish their products from those of other suppliers. The initial experience in nascent competitive markets suggests that efficiency and management services are already a key strategy used to attract commercial and industrial customers, while the prospects for green power appear to be strongest in residential markets.

The Act does not rely solely on the operation of the market to produce a positive environmental result. Specific provisions of the Administration's proposed legislation also provide direct environmental benefits. These include a renewable portfolio standard to ensure a minimum level of generation from non-hydroelectric renewable energy sources; consumer information provisions to help consumers identify and choose environmentally friendly generators; a public benefits fund to match State commitments for financing energy efficiency, renewable energy, and other public benefits programs; and a net metering provision encouraging the installation of small renewable energy systems.

Quantifying the Economic and Environmental Benefits of Competition

This paper presents modeling results that compare scenarios for electricity markets in the continental United States under cost-of-service regulation and competition. The scenarios were developed using the Policy Office Electricity Modeling System (POEMS). POEMS is a system that integrates two existing models, the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and TRADELEC™ an electricity model developed to evaluate competitive electricity markets in more detail than the standard NEMS electricity module (see Appendix D for an overview of the POEMS model).

The POEMS analysis examines the economic and environmental impacts of a transition to retail competition. However, the analysis does not attempt to explicitly account for state actions that are already beginning the transition to competition or reflect the timing of future actions that states might take to implement competition consistent with the Administration's proposed "flexible mandate" for retail competition. From an analytical perspective, it is difficult to isolate the economic and environmental effects of the Administration's proposed legislation from the effects of state actions alone. Moreover, the Administration's proposal will benefit consumers even in states where the transition to competitive markets is already underway by providing additional authority to help assure that potential gains from competition are actually realized.

- On the economic side, the Act strengthens the Federal Energy Regulatory Commission's (FERC) ability to require utilities' participation in regional independent system operators, enhances FERC's authority to remedy market power, requires strong consumer information disclosure, allows states to condition market access on reciprocal treatment, and clarifies state-federal jurisdictional boundaries to promote competition and maintain reliability.

- Similarly, provisions that provide important environmental benefits, such as the renewable portfolio standard and the public benefit fund, apply to all states, including those where the transition to competitive markets is already underway.

The focus of the POEMS analysis is the impact of full retail competition nationally compared to a continuation of cost of service regulation that includes wholesale competition. The main results of the analysis are as follows:

- The delivered cost of electricity to all consumers in 2010 in the Competitive Scenario is estimated to be $30.7 billion lower than in the Reference (cost-of-service) Scenario.

- The average national price of electricity is estimated to be 12 percent lower under competition in 2010. The largest reductions are realized in areas of the country with the highest cost-of-service rates. However, all regions of the country benefit from competition if, as under the Administration's proposed legislation, existing mechanisms for pricing and allocating power produced at federal facilities (preference power) are maintained.

- Projected emissions of carbon dioxide from the electricity sector are reduced by between 25 and 40 million metric tons, measured in terms of carbon content. This estimate reflects the net impact of the emissions-increasing and emissions-reducing effects of retail competition itself, as enhanced by specific environment-friendly provisions of the Administration's plan, such as the Renewable Portfolio Standard, the Public Benefit Fund, and the Consumer Information Provisions.

The POEMS analysis was informed by an effort to identify potential cost savings from restructuring, a summary of which is provided as Appendix C. Using information from reports filed by investor-owned and public utilities, quantifiable potential cost reductions resulting from competition in operations and maintenance costs, administrative and general costs, more efficient use of the transmission and distribution system, and capital cost savings at existing facilities are estimated to exceed $20 billion annually. This estimate does not include: the savings that would result from a reduction in the need for new capacity due to more efficient pricing, the benefit to consumers of avoiding the costs of any future mistakes with respect to capacity planning, technology choice, or project management that have in the past raised the cost of power to consumers; or the greater economic value to consumers of new products and services that will be created in a competitive environment.

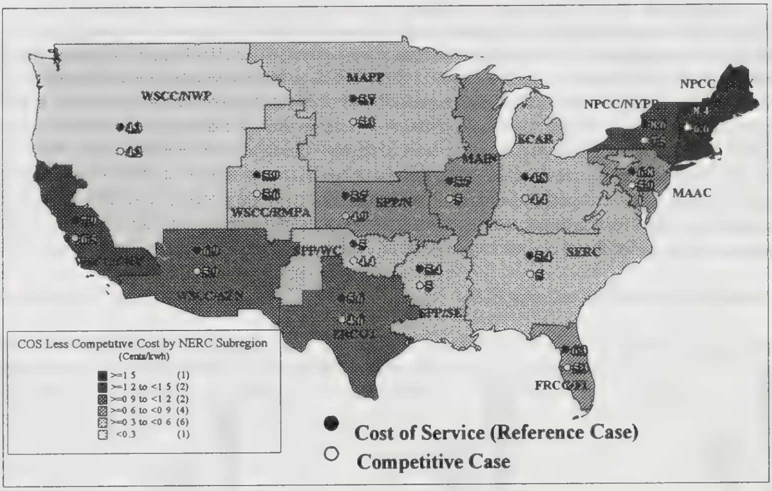
The remainder of this document summarizes the POEMS analysis. Section 2 presents the results. Section 3 presents key assumptions used in the analysis and the rationale for the scenario formulation. Section 4 discusses future direction of the modeling and analytic efforts. Appendix A provides supplementary figures and graphs. Appendix B provides a summary table of results. Appendix C summarizes an analysis of costs at existing plants that was used to derive projected efficiency improvements for the Competitive Scenario. Appendix D provides documentation for the POEMS.

Section 2. Results of the POEMS Analysis

Electricity Prices and Stranded Costs

The introduction of retail competition is projected to lead to lower electricity rates for customers in all regions of the country. Figure 1 illustrates the projected average electricity prices in 2010. These prices are the average across all customer classes and include generation, transmission, and distribution costs, and stranded cost recovery.

Figure 1. Projected Average Retail Electricity Prices in 2010 (1995 cents/kWh)



Notes: The Competitive Scenario reflects cost of service rates for Federal preference power customers.

Both the Reference and Competitive scenarios include projections of declining electricity rates. In 1995, the national average delivered price was 6.9 cents per kilowatt-hour (kWh). With continued cost of service regulation, the price in 2010 is projected to be 5.9 cents per kWh. The decline is the result of capital cost depreciation of existing high cost plants, as well as the continued entrance of more efficient capacity. With retail competition, greater efficiencies and marginal cost pricing lead to larger price reductions, and the national average price is projected to be about 12 percent lower, or 5.2 cents per kWh in 2010.

As shown in Figure 1, there is a wide range of projected prices with continued cost of service regulation, ranging from 4.3 cents/kWh in the Pacific Northwest to 8.6 cents/kWh in New York. With competition, the variation in price is likely to be smaller, ranging from 4.2 cents/kWh in the Pacific Northwest to 7.5 cents/kWh in New York[1]. In general, the regions projected to have the highest prices under cost of service regulation are those that are likely to see the largest decrease in prices under competition. The remaining regional variation is due to differences in fuel prices, operating costs, transmission costs, transmission constraints, distribution costs, and stranded cost recovery. Differences in transmission and distribution costs are the most important factors.

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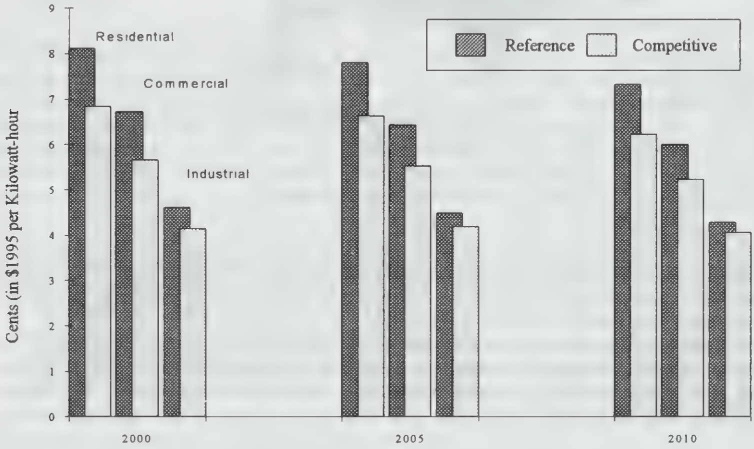
[1] Consistent with the Administration's proposed legislation, the Competitive scenario maintains existing mechanisms for pricing and allocating power produced at federal facilities.

Consumer savings are projected for all classes of customers: residential, commercial, and industrial. A comparison of 2010 national cost of service and competitive rates by customer class is shown in Figure 2. Residential customers are projected to see the largest price decreases in 2010 with competition. In part, this is because historical capacity costs were allocated to customer classes based on their contribution to peak demand. Residential customer demand tends to have more variation by time of day and season than industrial and commercial; therefore, it receives a relatively greater share of the costs under peak demand allocation than if costs were allocated based on sales. Although the energy costs associated with peak demands are generally high, the capital costs for peaking turbines is relatively low compared to baseload units. In the competitive market, higher marginal costs at peak periods will lead to higher average generation prices for residential customers than for customer classes with flatter load profiles, but with less of an average premium than under the previous capital cost allocation.

Figure 2. Electricity Prices by Customer Class



The competitive prices include the recovery of a projected $85 billion in stranded costs for existing and productive generating assets. When stranded costs for existing and productive generating assets are recovered over a 10-year period as described below, the national average additional charge to the average electricity price is 0.2 cents per kWh in 2010. On a regional average basis, stranded cost recovery factors are projected to range from 0.03 to 0.5 cents per kWh. Within regions, stranded cost recovery factors will vary across individual utilities due to differences in generating asset portfolios and price differences across power control areas.

The Competitive Scenario also provides for recovery of regulatory assets and decommissioning costs. The pace of recovery in these categories for both scenarios reflects recent state-level practices, and is assumed to be similar to projected recovery in the Reference Scenario. Provision for recovery of regulatory assets and decommissioning costs adds 0.1 cents per kWh to the estimated national average price of electricity in 2010.

Electricity Demand

The underlying electricity demand forecast, which is taken from the EIA Annual Energy Outlook, projects electricity growth of 1.5 percent per year from 1995 to 2010. There are several elements of the Act that will affect this demand. Lower electricity prices resulting from competition are likely to stimulate additional demand for electricity. This is dampened to some extent by lower projected natural gas prices that result from overall lower gas demand. The proposed provision for a Public Benefits Fund and the expectation that competition will spur efforts to package energy efficiency (and other energy service products) with power sales, also are projected to reduce demands. The net result is slightly higher electricity demand in the near term and lower demand as the Act comes into full effect. By 2010, projected electricity demand is 2.4 percent lower with the Act than in the Reference Scenario.

Generation Capacity

Most of the generation capacity used in 2010 will be capacity that exists today. For example, in the Reference Scenario in 2010 only 20 percent of the projected total capacity are new additions. Currently, coal plants account for 41 percent of all capacity. Other major types of capacity are: other fossil (oil and gas) steam at 19 percent, nuclear at 14 percent, hydroelectric at 13 percent, and combustion turbines at 8 percent. Gas-fired combined cycle plants and all other renewables have relatively small shares, at 4 and 1 percent respectively. In the future, this mix is projected to shift more towards gas technologies and away from coal and nuclear plants.

In both the Reference and Competitive scenarios, the greatest share of new construction is projected to be gas-fired combined cycle plants. This result reflects the combined effect of high efficiencies, short construction periods, modularity, and modest projected increases in natural gas prices. In the Reference Scenario, they are projected to represent 59 percent of the cumulative new plants from 1995 to 2010, with gas-fired combustion turbines that serve peaking requirements capturing an additional 27 percent of total capacity additions.

The dominant change in the mix of future generating capacity in the Competitive Scenario is the increase in the share of renewable capacity (see Figure 3) that results from the Renewable Portfolio Standard included in the Administration's proposal and consumers' interest in green power. Less capacity of other types of plants are needed as a result. However, much of additional renewable capacity is intermittent. For example, generation from wind power is dependent on when the wind is blowing and therefore operates less than a plant that can be run 24 hours a day. Because of this, much of the renewable capacity added receives only a partial credit towards meeting capacity requirements. This results in more installed capacity under the Administration's proposal than in the Reference Scenario, even though demand is slightly lower.

Electricity Generation

The differences in generation by fuel type across the Reference and Competitive scenarios (see Figure 4) do not directly track the differences in capacity additions outlined above. Because competition will provide strong incentives to run low-cost plants more efficiently and to shorten scheduled outage periods, existing coal and nuclear plants are run more often in the Competitive Scenario. As a result, even though there is slightly less coal capacity, coal generation in the

Competitive Scenario is actually slightly above the Reference Scenario level. The change in non-hydroelectric renewable generation under the Administration's proposal is significant, as shown in Figure 5. Because of the proposed Renewable Portfolio Standard and consumers' interest in green power, non-hydro renewables generation in 2010 is projected to be 6.3 percent of total generation in the Competitive Scenario, approximately twice its share in the Reference Scenario. All of other types of generation are below the Reference Scenario levels in the Competitive Scenario.

Figure 3. Cumulative Change in Capacity by Plant Type, 1995 Through 2010

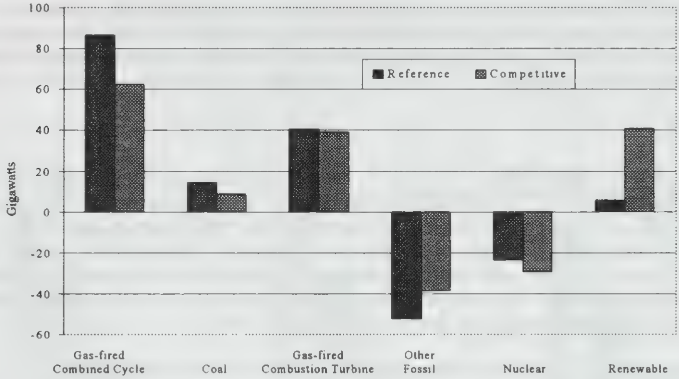


Figure 4. Change in Generation by Fuel and Region in 2010 (Competitive less Reference Scenario)

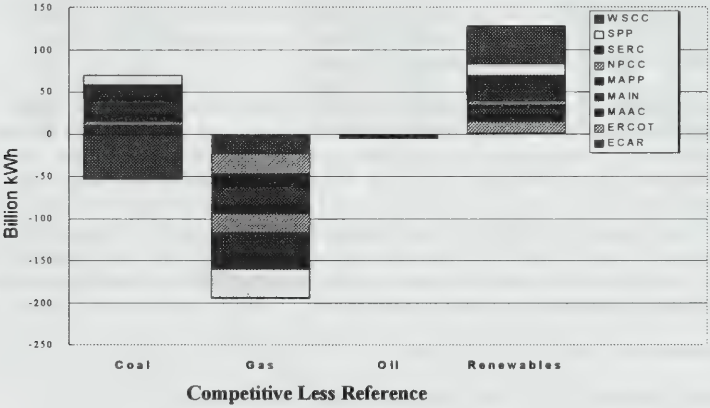
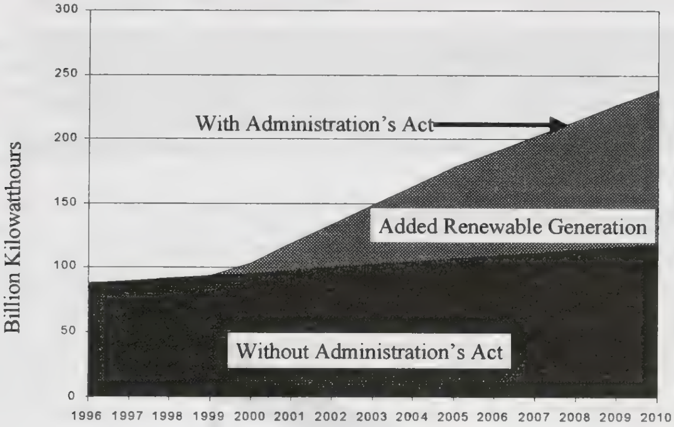


Figure 5. Non-Hydro Renewable Energy Generation



Carbon Emissions

Carbon emissions from electricity generation are projected to increase by 166 million metric tons of carbon equivalent (MMTCE) between 1995 and 2010 in the Reference Scenario. In the Competitive Scenario, carbon emissions are projected to be 39 MMTCE lower than the Reference Scenario in 2010.

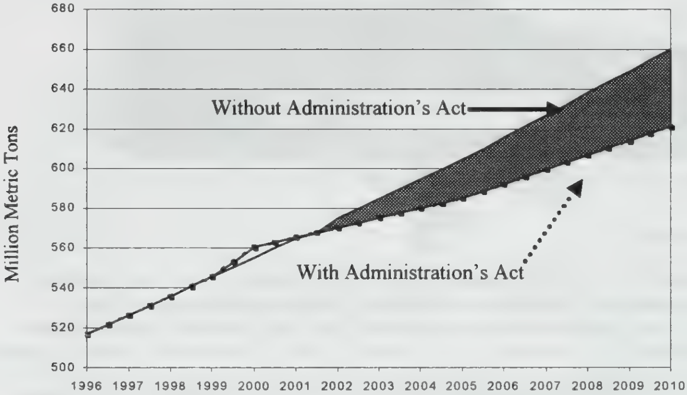
Recognizing the inherent uncertainty of future market developments, the Administration estimates that its proposal will lead to emissions reduction of between 25 and 40 MMTCE in 2010. This approach parallels the conservative approach used in evaluating economic benefits, which recognizes that the impacts of the Administration's proposed legislation and those of competition itself are not easily separated. Emissions reductions in this range are likely to be achieved even if most of the uncertainties discussed below are ultimately resolved in a direction that tends to increase emissions beyond the modeled level.

As shown in Figure 6, carbon emissions may rise slightly in the early years of competition compared to the Reference Scenario with continued regulation. However, as existing coal plants become fully utilized, the Renewable Portfolio Standard requirements increase, and additional energy efficiency investments take place, emissions grow more slowly. Another factor leading to lower emissions is the improved efficiency in power generation, as generators faced with competition have a direct financial incentive to reduce their input costs.

Key Uncertainties Affecting Carbon Emissions

Improvement in heat rates and capacity availability. There is considerable uncertainty regarding the extent of heat rate or capacity availability improvements likely to occur at existing plants in a competitive scenario. Heat rate improvements and capacity availability improvements at fossil-fired plants work in opposing directions, with the former tending to reduce carbon emissions and the latter tending to increase them. Should either of these improvements in a competitive environment diverge from the estimates used in the Competitive Scenario, carbon emissions would be directly affected.

Figure 6. Carbon Emissions from Electricity Generation



Other state-level and private decisions under competition. Decisions that could result in lower-than-modeled emissions include higher energy-efficiency spending due to either competition among retail electricity suppliers or the operation of the Public Benefits Fund (the results presented here assume an incremental $2 billion annually in efficiency spending due to the public benefit fund), more consumer interest in green power, fewer nuclear retirements due to competition, or lower than assumed availabilities for coal-fired power plants. Forces that could result in higher-than-modeled emissions include additional nuclear retirements attributable to competition, greater responsiveness of demand to price reductions than provided for in the demand modules of the National Energy Modeling System, or a binding Renewable Portfolio Standard cost cap that is not offset by increased green power demand.

Emissions of Nitrogen Oxides and Sulfur Dioxide

The Administration's proposal includes provisions that clarify Environmental Protection Agency (EPA) authority to require a cost-effective interstate trading system for nitrogen oxide (NO_x) pollutant reductions addressing the regional transport contributions needed to attain and maintain the ozone ambient air quality standard. However, no change is proposed to existing EPA authority to determine geographic coverage or level of reductions required in addressing regional transport contributions.

Consistent with these provisions, the projected level of nitrogen oxide emissions will primarily be determined by past, pending and future actions taken by EPA under its existing regulatory authorities. For example, the emissions level in 2000 and beyond are significantly below the 1995 level in both the Reference and Competitive scenarios due to the Phase 2 Clean Air Act NO_x standards, which were included in both cases. Starting from existing emissions rates as modified by the Phase 2 standards in 2000, both annual and summer season NO_x emissions in the Competitive Scenario are projected to be roughly 4 percent below projected levels in the Reference Scenario in 2010. The projected reduction in NO_x due to competition generally results from the same set of factors that provides the reduction in carbon dioxide emissions discussed in the previous section.

These POEMS model results do not reflect the Environmental Protection Agency's pending proposal to establish absolute caps on ozone season NO_x emissions for 22 States and the District of Colombia or the reductions currently being undertaken within the eastern States comprising the Ozone Transport Commission. As noted above, such actions under existing regulatory authority will be the primary determinant of future emissions levels. For example, in regions and seasons where regulatory actions take the form of an absolute cap on the level of emissions, the cap itself would determine the level of NO_x emissions independent of the price of electricity or the structure of electricity markets for those regions and seasons in which it was applicable.

This observation may be applied directly in the case of sulfur dioxide emissions, since an annual nationwide cap on sulfur dioxide emissions from the electric utility sector has already been established pursuant to the 1990 Clean Air Act Amendments. For this reason, emissions of this pollutant are projected to be the same in both scenarios.

Section 3. Model Assumptions

Scenario Definition and Baseline Assumptions

In order to measure the impacts of the retail competition, a baseline must first be established. As with any forecasting exercise, this Reference Scenario is meant to be a reasonable expectation of possible future events and not a statement of what will happen. For this analysis, the Reference Scenario assumes a continuation of existing forms of utility regulation and cost-of-service pricing. The Competitive Scenario represents implementation of retail competition as envisioned in the CECA.

The Reference Scenario assumes wholesale competition as achieved through open transmission access under FERC Order 888. All new capacity is assumed to be built by exempt wholesale generators and not included in the rate base of utilities. In addition, transmission fees are *pancaked*. In other words if power is wheeled across two transmission systems, each will charge a separate fee for providing the transmission service.

The Reference and Competitive scenarios share the same underlying macroeconomic and energy sector assumptions, which are taken from EIA's Annual Energy Outlook 1997. However, the electricity demand and fuel price projections are not identical between scenarios, because of the feedback with electricity prices, fuel demands of the electric sector, and other sectors fuel prices due to the transition to competition and specific provisions of the CECA.

The Administration's proposal was represented in the POEMS model through a range of assumptions that represent a vision of how a full retail competition market might emerge as a result of the Administration's proposed policies. Table 1 outlines the major set of assumptions and provides a comparison with the Reference Scenario. Each of these assumptions is discussed below in the context of the Act.

Electricity Pricing, Stranded Assets, and Plant Retirements

The generation price in the Competitive Scenario is composed of the marginal generation cost, ancillary charges, a renewable portfolio standard (RPS) premium (if applicable), and stranded cost recovery charges. Marginal generation cost is established in each power control area (PCA) based on the bid price of the last unit running in each time/season period. The last unit could be native to the PCA or determined through trade with other PCAs. In accord with the standard economic model of perfect competition, the bid price for each unit is assumed to be its marginal cost -- the sum of fuel cost and the variable portion of operating and maintenance (O&M) costs.

As stated in the Comprehensive Electricity Competition Plan (announced March 25, 1998), the Administration "endorses the principle that utilities should be able to recover prudently incurred, legitimate and verifiable retail stranded costs that cannot be reasonably mitigated". The Competitive Scenario assumes that stranded costs associated with productive generating assets are recovered over a ten-year period following the introduction of competition. Recovery of regulatory assets and decommissioning costs in the Competitive Scenario is assumed to be similar to that in the Reference Scenario, with the pace of recovery in these categories for both scenarios reflecting recent state-level practices.

Retirement of plants is economically driven. The economic retirement decision for all generating plants is based on both short-term and long-term criteria. The short-term requirement is that plants can cover their "going-forward" costs, which includes all fixed and variable O&M costs as well as recovery of the annualized value of new capital additions. If a plant cannot cover these costs, it becomes a candidate for early retirement. The second consideration is the cost of building new generating capacity. In the capacity-planning module, all existing units must pay their going-forward costs if the capacity is to be used over the full planning horizon. Thus the planning module has the opportunity to "decide" to economically retire any or all of the existing units and instead build new capacity. If the planning module does decide to economically retire a unit and this same unit did not cover its variable costs in the last forecast year, it is retired. A plant must be uneconomic in both the short-term and long-term to be retired.

Table 1. Reference and Competitive Scenario Assumptions

Category	POEMS Reference	POEMS Competitive
Electricity Markets	Competitive Wholesale Cost of Service Regulated Retail	Competitive Wholesale Competitive Retail
Market Power	None (regulated monopoly)	None (perfect competition)
Macroeconomic Scenario (GDP growth)	AEO97 Reference Case (1.5%/year 1995 to 2010)	AEO97 Reference (1.5%/year 1995 to 2010)
Cost of Capital	12.8% weighted average	14.0% weighted average
Demand	AEO97 demand modules	AEO97 demand modules
Energy Efficiency	AEO97 Reference Case	AEO97 Reference + Public Benefit Fund + "bundled efficiency" savings
Renewables	No Special Requirements	Portfolio Standard Requirement 5.5% non-hydro renewables in 2010 Green Power: 2.5% of residential demand
Generation Pricing	Cost of Service; new plants sell output under long-term contracts	Marginal Cost Pricing, where variable costs equal fuel costs plus a percentage of O&M (percentage varies by technology)
Ancillary services	Included in Cost of Service	Endogenously derived. Included in prices
Transmission		
- Hurdle rate	$3/mwh	$1.5/mwh
- Organization	Pancaked	Postage Stamp
- Wheeling Fees	80% FERC Order 888	50% FERC Order 888
O&M and G&A Costs		
- Generation		
- O&M	Improvement through plant mix only	Improvement to 50-75% of targets from quartile analysis
- G&A	1% per year decline	5% per year decline, 2000 to 2010
- Transmission	No Change	0.75% year decline, 2000 to 2010
- Distribution	No Change	1.5% per year decline, 2000 to 2010
Heat rates	Improvement through plant mix only	Improvement to 50% of targets from quartile analysis
Availabilities	Coal/gas/oil steam at 90 percent Nuclear varies by region, based on AEO98	coal/gas/oil steam at 90 percent nuclear outages are 1/3 less than Reference Scenario, subject to 90 percent cap
Reserve Margins	8% for all regions, except 4% for Florida	8% for all regions, except 4% for Florida
Stranded Cost Recovery		
- Generating Assets	Not applicable	10 year recovery, 10% discount, 100% recovery
Transitional Charges		
- Regulatory Assets	Start year 1995, est. current recovery periods, near 0 discount, 100% recovery	Same as Reference
- Decommissioning costs	Start year 1995, average 25 year recovery, 10% discount, 100% recovery	Same as Reference

Operating Costs: Generation, Transmission and Distribution

As the electric power industry is transformed into a more competitive, market-based industry, the historical level of costs are expected to be reduced due to the pressures of competition. In the generation segment of the industry, costs per unit of output will decrease due to the changing mix of capacity, i.e., more expensive generating units are replaced by new, more efficient generating technology (typically natural gas fueled). In the Competitive Scenario, competitive pressures are expected to lower costs at existing generating facilities as well, as they begin to compete with other existing and new facilities. Competitive pressures are assumed to also spill over into the regulated segment of the industry. Transmission productivity improves by 0.75 percent per year and distribution productivity improves by 1.5 percent per year to 2010 due to the introduction of performance incentives to improve productivity in these functions.

Cost of Capital

Under competition, electricity generators will not be guaranteed a fixed rate of return on their investments. As a result, plant owners will demand a greater expected return to compensate for the risk associated with their revenues. They will also need to finance their investments with less reliance on debt and more on equity. The weighted cost of capital is 12.8 percent in the Reference Scenario and 14 percent in the Competitive Scenario.

Heat Rate Improvement

Historically, utilities were not rewarded for reducing their fuel costs. In fact, in many states, fuel costs were directly passed through to consumer bills. As long as a utility was acting "prudently," regulators would provide little pressure to reduce these costs. This is likely to explain in part why there is currently a very wide range of heat rates in power plants of the same type, size, and age. With intense competitive pressures, generator owners are likely to make cost-effective improvements and change their operations to improve the efficiencies of these existing plants. Any improvements will lead either directly to increased profits or allow the plant to continue to operate where it might otherwise be priced out of the market. Based on an analysis of existing heat rates, the Competitive Scenario assumes that existing plants will make significant strides towards achieving heat rates closer to those of the top 25 percent of comparable plants.

Capacity Availability Improvement

Competition will also give generators an incentive to maximize the availability of their facilities because they will only receive revenue when they are operating. In the Reference Scenario, fossil-fuel-fired steam units are assumed to have availabilities of 85 percent. Nuclear availabilities vary by region and are based on EIA's AEO98 assumptions. In the Competitive Scenario, the steam units are assumed to have 90 percent availabilities, which is equivalent to a one-third reduction in the outage times. A one-third improvement was applied to the nuclear units as well, with a maximum of 90 percent availability. For most regions, the resulting nuclear availabilities fall below the 90 percent cap.

Transmission System

The Federal Energy Regulatory Commission, in its Order No. 888, required *that "... seller(s) (and each of its affiliates) must not have, or must have mitigated, market power in generation and transmission and not control other barriers to entry."* [2] For transmission owning utilities, this meant that the utility must have on file with the Commission an open access tariff for the provision of comparable service. The Competitive Scenario assumes that all transmission owners have an open access tariff over which retail and wholesale sales can occur. The Competitive Scenario, as in the Reference Scenario, assumes that exempt wholesale generators (EWGs) will provide all new generation capacity. The Competitive Scenario assumes that all consumers (i.e., residential, commercial and industrial) will have equal access to the power exchanges.[3] To assure that consumers of all types have the necessary information to make these informed decisions, the Administration's proposal provides for a uniform label information on price, terms and conditions of service.

Transmission fees were computed using a formula similar to the pro forma tariff described in Order No. 888. In the Reference Scenario, the transmission fees were assumed to be *pancaked*[4]. In the Competitive Scenario, the assumption is that regional transmission groups (RTG), tied together by an independent system operator (ISO) would operate the transmission grid(s). The transmission fees in the Competitive Scenario were therefore assumed to be the same for moving power across the entire RTG region (i.e., a postage stamp rate). Since the bulk of the costs associated with the transmission system are allocated to the native load customers, the transmission fees used were discounted. In the Reference Scenario the discount was 20 percent and in the Competitive Scenario, the discount was 50 percent.

Renewable Portfolio Standard and Green Power

A Renewable Portfolio Standard (RPS) was included as a national standard with potential trading of credits. This means that renewable generation can be constructed wherever it is most cost-effective, rather than requiring it to be spread evenly across the nation. The standard was expressed as a percent of sales that must be met with renewables and was assumed to increase gradually over the 2001 to 2010 period. In 2010, the RPS was set at 5.5 percent. All non-hydro renewable generation qualifies to meet the standard, including industrial cogeneration. Because of the ability to trade credits, renewables will command the same price premium nationally, equivalent to the marginal cost. The premium is paid by all customer classes on a cents per kilowatt-hour basis.

The Competitive Scenario assumes that in addition to the RPS standard, 5 percent of residential customers nationwide would be willing to pay for additional Green Power, which is comprised of 50 percent new non-hydro renewables, above what the RPS requires[5]. The labeling provisions of the CECA will provide consumers with the information that they need to be able to choose their

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[2] See page 63.

[3] Residential and commercial consumers (and small industrial consumers) may utilize "aggregators" to achieve the economy of scale necessary to effectively access the competitive market.

[4] In the Reference scenario, each Power Control Area (PCA) was considered a transmission entity. Electricity trade through a PCA resulted in the addition of a transmission tariff. In the Competitive scenario, PCA's were grouped into Regional Transmission Groups (RTGs) and one tariff was established for the region as a whole.

[5] This is equivalent of 2.5 percent of residential demand as specified in Table 1.

generation suppliers based on price and the environmental factors important to them. Pilot programs in various states, as well as activity in California, support the assumption that a segment of consumers will value these qualities.

Public Benefit Fund and Integrated Energy Services

The Administration's proposal calls for the creation of a $3 billion Public Benefits Fund to be matched by states and used for energy efficiency programs, technology research projects, low-income assistance, and consumer education. In addition, with electricity suppliers competing to meet the needs of customers, they are likely to offer a full range of energy services in order to be competitive. Energy efficiency improvements are already being offered in some of the nascent retail competition areas. Together these efficiency improvements are assumed to reduce electricity demand by 2 percent in 2010. The modeled scenario was developed in the context of a $2 billion increment to annual baseline energy-efficiency expenditures over the 2000 to 2010 period. Additional expenditures in energy efficiency would reduce electricity demand further.

Section 4. Next Steps

This paper is intended to inform discussions of restructuring policy by comparing a generic cost-of-service scenario to a retail competition scenario that is consistent with the main elements of the Administration's Comprehensive Electricity Competition Act. Further analyses can provide additional insights as these discussions unfold. While some future analyses will be driven by the specific elements of alternative proposals, some issues that have already been identified as potential subjects of future analysis are briefly summarized below:

Transmission constraints: Transmission plays an important role in the modeling analysis of competition, since only in the presence of transmission constraints will prices in adjacent competitive markets differ by more than the transmission fee plus line losses. Electricity flows on the transmission system do not generally follow the contract path, and the available capacity between two market areas may be influenced by power flows throughout the system. For this reason, it is important to verify the POEMS representation of transmission constraints using tools that can follow physical flows. Work in this area is underway in cooperation with the North American Electric Reliability Council and other transmission experts.

The timing and scope of competition: Notwithstanding the difficulty of separating the projected effects of the Administration's proposal from those attributable to other steps towards competition, sensitivity scenarios addressing this issue could provide useful insight into the likely impact of alternative transition paths.

Nuclear retirements: For both emissions and economic reasons, there is considerable interest in the implications of competition for continued utilization of existing nuclear plants. A further assessment in this area would review the characterization of retirements in the Reference Scenario and the criteria used to drive retirements in the Competitive Scenario. The role of risk relative to expected profitability in driving retirement decisions should plant owners be called upon to make an early declaration regarding their intended retirement decisions also merits further attention. Finally, the implications of a scenario in which competition results in a concentration of nuclear operations in the hands of firms with a proven record of efficient, safe, and economical operation of these facilities should also be considered.

Alternative Allocations of Stranded Costs: In the same manner that rates under cost-of-service regulation are affected by the allocation of new capacity costs across customer classes, prices in the transition to competition will depend on how the costs of uneconomic generating assets are allocated. Sensitivity analyses could scope out the range of possible outcomes.

APPENDIX A:

SUPPLEMENTARY FIGURES AND GRAPHS

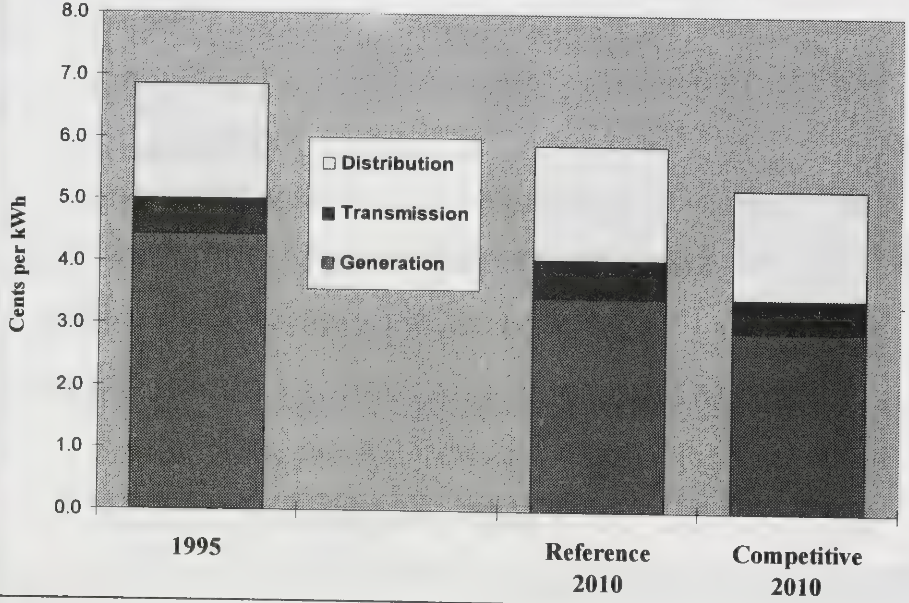
OUTLINE OF APPENDIX

- Key Components of the Comprehensive Electricity Competition Act
- Reference and Competitive Case Assumptions
- Analytic Results
  - Prices
  - Stranded Assets
  - Emissions
  - Trade
  - Generation
  - Consumption

Key Components of the Administration's Plan

- Flexible Mandate for Retail Competition by 2003
- Consumer Information Provisions
- Enhanced Reliability Through Requirements for Industry-Wide Reliability Standards Monitored by FERC
- Supports Recovery of Prudently Incurred Legitimate and Verifiable Stranded Costs
- Renewable Portfolio Standard
- Public Benefit Fund
- Revise Federal Electricity Law
  - Repeal PUHCA
  - Repeal PURPA
  - Update the Federal Power Act

COST OF SERVICE AND COMPETITIVE ELECTRICITY PRICES (1995 cents/kWh)



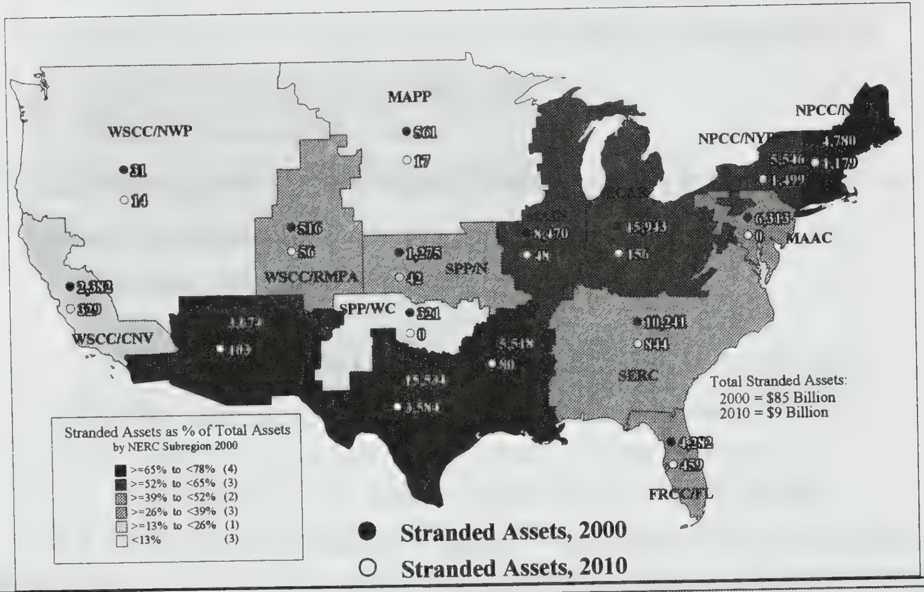
CATEGORIES OF STRANDED COSTS

- Existing and Productive Generating Assets
- Regulatory Assets/Deferred Costs
- Contracts and Other Transition Costs
  - Fuel Contracts
  - QF Contracts
  - Purchased Power/Power Sale Contracts (Cooperatives, Municipals, and IOUs)
- Plant Decommissioning (particularly nuclear)

STRATEGY FOR ESTIMATING STRANDED EXISTING AND PRODUCTIVE GENERATING ASSETS

- Compute Annual Competitive Surplus By Generating Asset
  - Compute Competitive Projected Annual Revenues (Prices * Quantities Sold)
  - Compute "Going Forward" Costs
  - Compute Present Value of the Competitive Surplus (Revenues - Cost)
- Compute Present Value of Regulated Allowed Return of and on Capital by Generating Assets.
  - This is equal to the net book value of the plant
- Stranded Assets are the Difference Between Present Values of Competitive Surplus and Regulated Allowed Return
  - Sum asset level results for the business unit and assign to two groups (positive and negative)

STRANDED PRODUCTIVE GENERATING ASSETS BY NERC SUBREGION 2000 AND 2010 (Millions $)



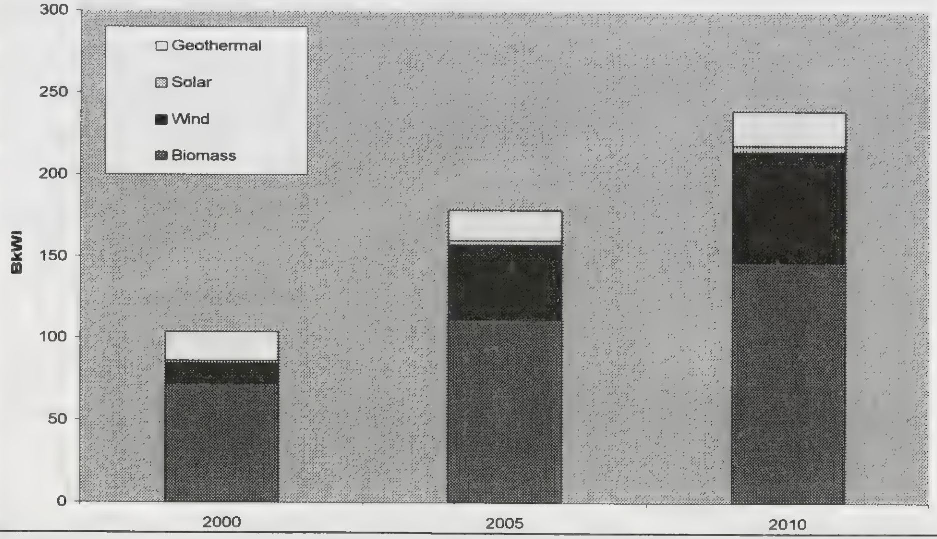
STRANDED ASSET SUMMARY

- A switch to Marginal Cost Pricing in 2000 could result in Stranded Productive Generating Assets of $85 billion in that year. Assuming that Cost of Service Ratemaking works perfectly, a delay in the advent of competition reduces the amount of stranded assets.
- Regulatory Assets and Existing Contracts (e.g. Fuel, QFs, Purchased Power) are potential sources of additional costs that could be stranded under some scenarios.
- Future Plant Decommissioning Costs (mostly nuclear) are an issue with or without Retail Competition and are included in both Reference and Competitive Scenarios.

Renewable Portfolio Standard (RPS)

- The RPS directly increases renewable capacity and generation.
  - although not uniformly distributed across regions, renewables are added in all regions of the country.
  - wind and biomass account for most additions.
- With the RPS, gas generation is lower and therefore gas consumption and prices are also lower.
- The presence of renewables decreases the short-run marginal cost of generation by shifting the dispatch curve.
- In aggregate, the price decrease partially offsets the premium consumers must pay to support the additional renewables.

Renewable Portfolio Standard and Green Power -- Generation by Fuel (BkWh)



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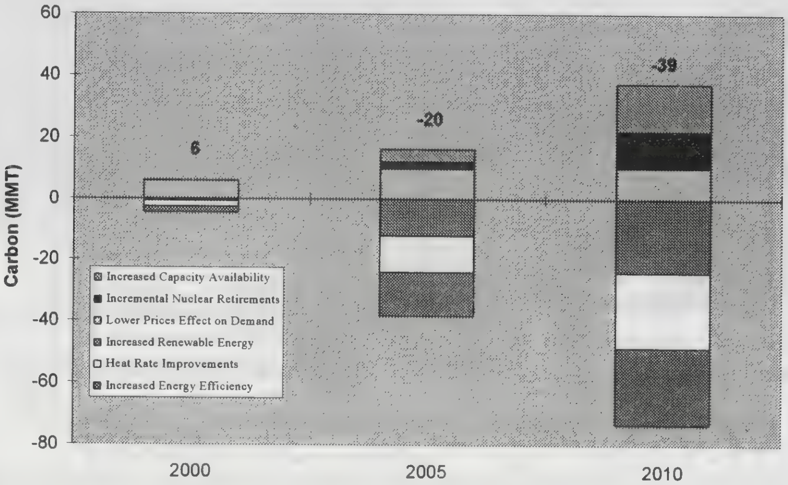
EMISSIONS IMPLICATIONS

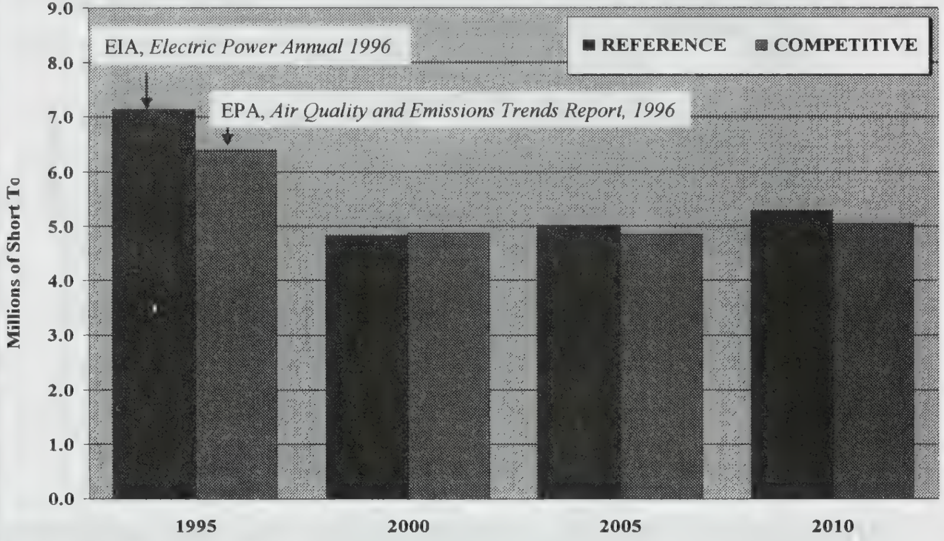
Some restructuring forces work to increase emissions (+), while others work to reduce them (-):

- Demand response to price reductions (+)
- Increased incentive for heat rate improvement (-)
- Reduction of fossil energy consumption in end-use sectors(-)
- Product differentiation, including efficiency services marketing (-) and green power (-)
- Load shifting (mostly +, but some -)
- Cost of capital (mostly -, but some +)
- Dispatch changes (initially +)
- Stranded cost recovery (-)
- Renewable portfolio standards (-) or added support for energy efficiency programs (-)

Elements Contributing to Carbon Savings (MMTCE)

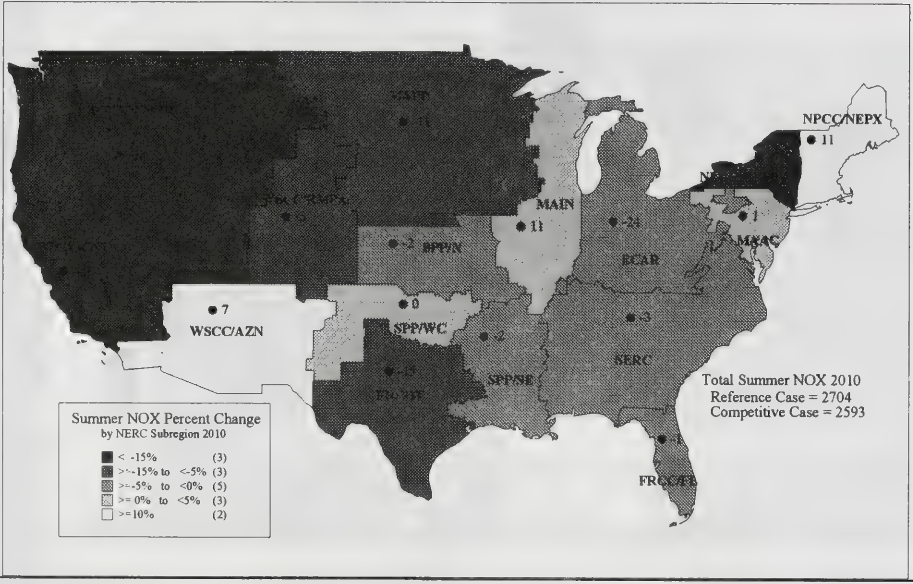


ANNUAL NOx EMISSIONS



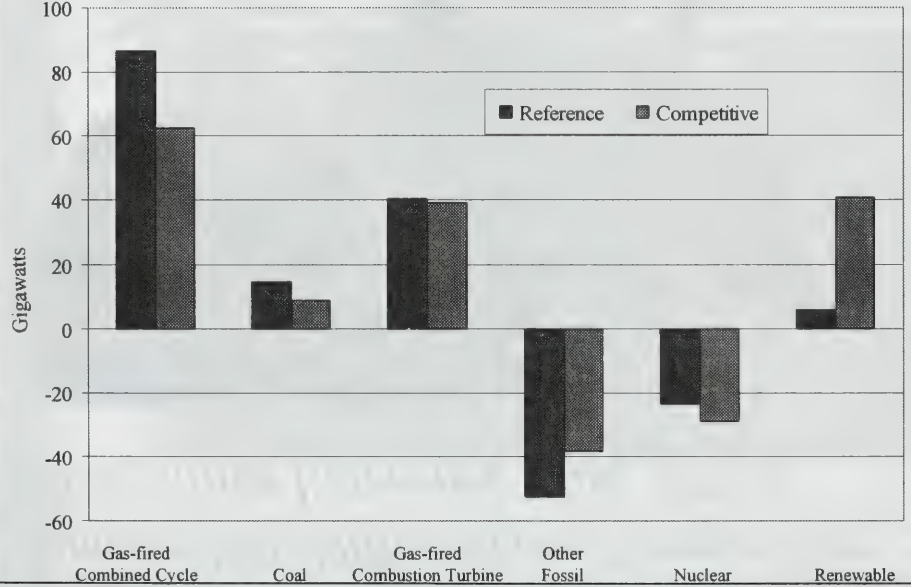
Note: Phase 2 NOx standards, but no new actions to address ozone non-attainment under existing or clarified authority, are modeled. EPA's proposed NOx SIP Call could result in further significant reductions in projected emissions .

Summer NO_x Differences - Competitive Case minus Reference Case (2010)



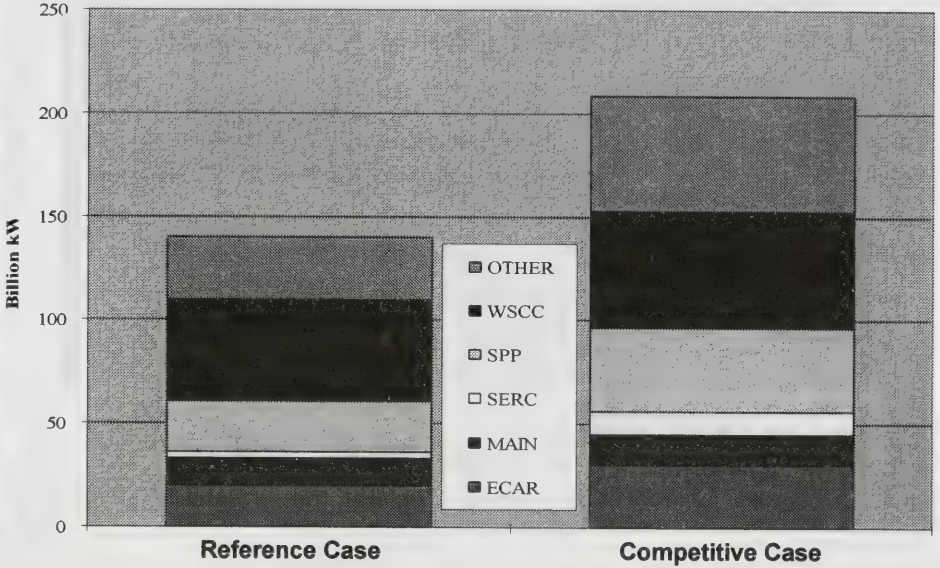
Total Summer NOX 2010
Reference Case = 2704
Competitive Case = 2593

Cumulative Change in Capacity for Reference and Competitive Cases, 2010



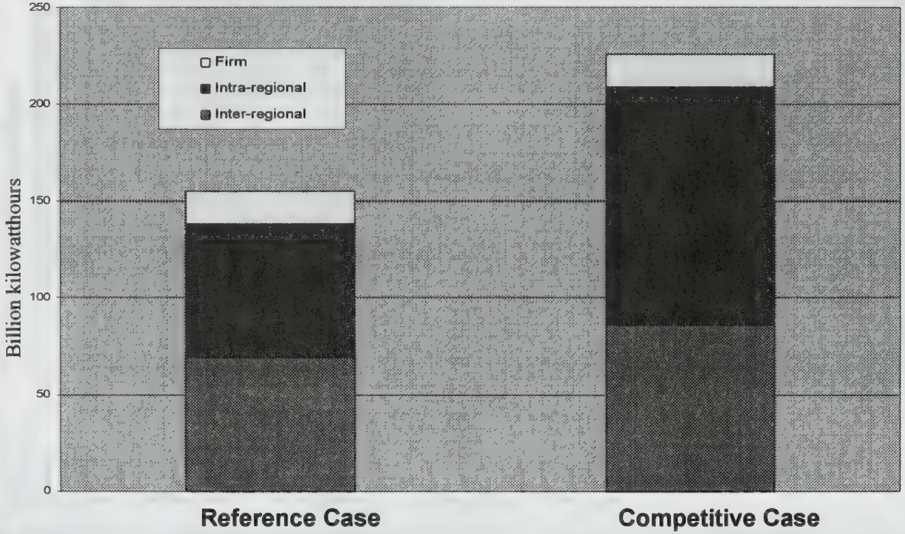
ELECTRICITY TRADE (YEAR=2010)

BY NERC EXPORT REGION

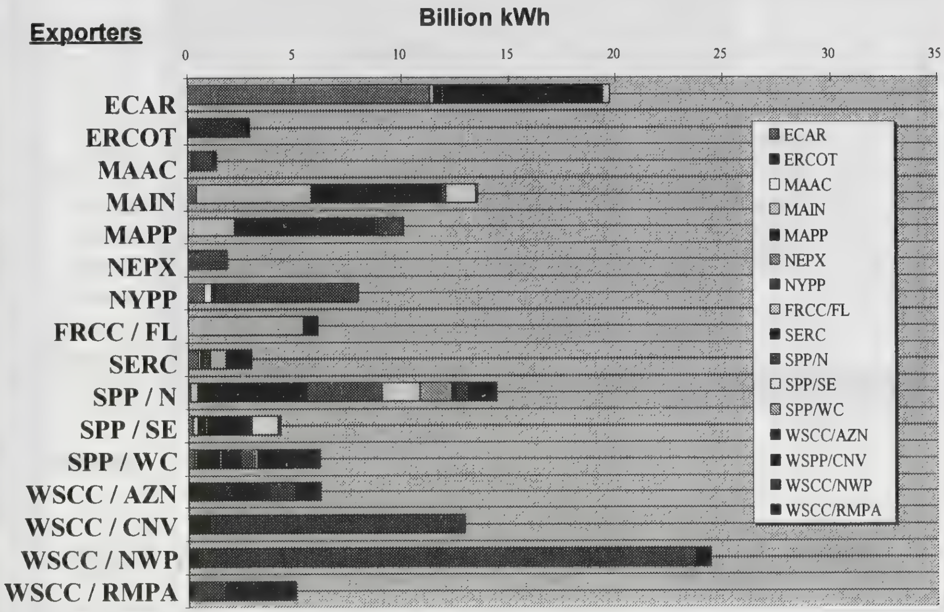


ELECTRICITY TRADE (YEAR=2010)

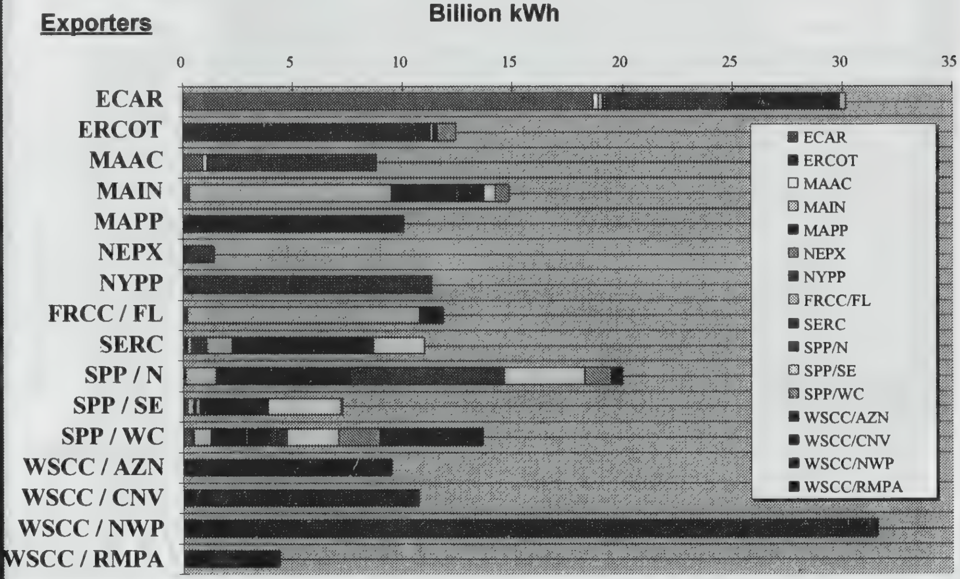
INTER V. INTRAREGIONAL SALES



TRADING PARTNERS: Reference Case



TRADING PARTNERS: Competitive Case



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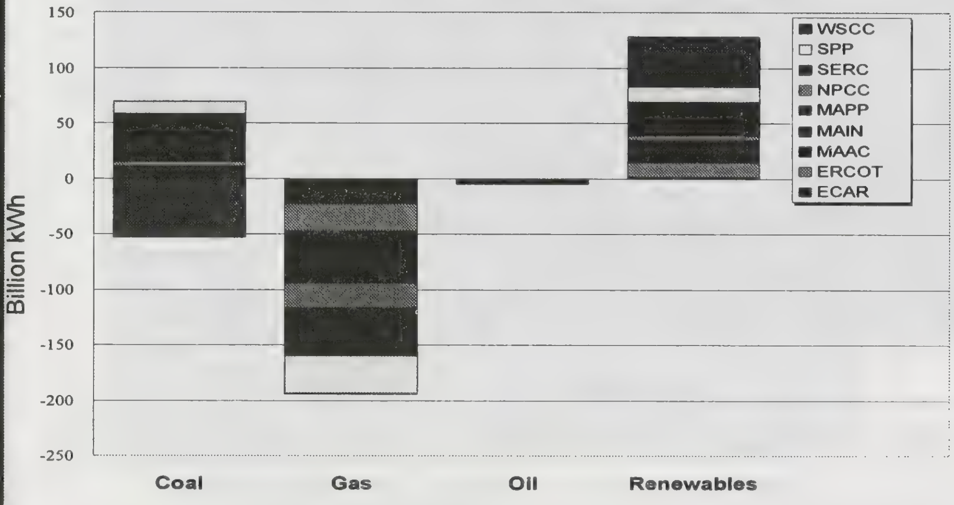
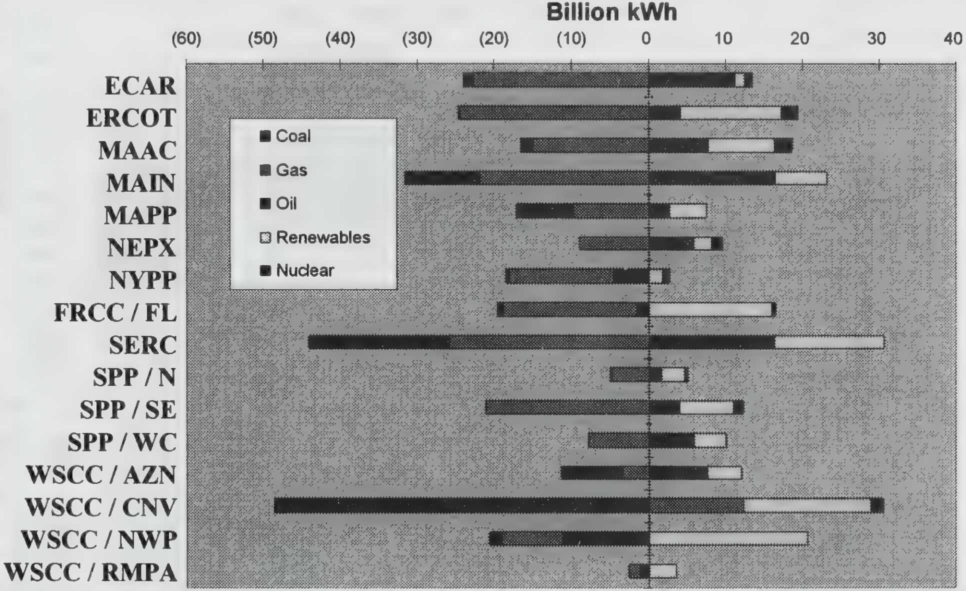
CHANGES IN GENERATION MIX ACROSS SCENARIOS (YEAR=2010)



Competitive Less Reference

CHANGES IN TOTAL GENERATION:
COMPETITIVE VS. REFERENCE CASE (YEAR=2010)



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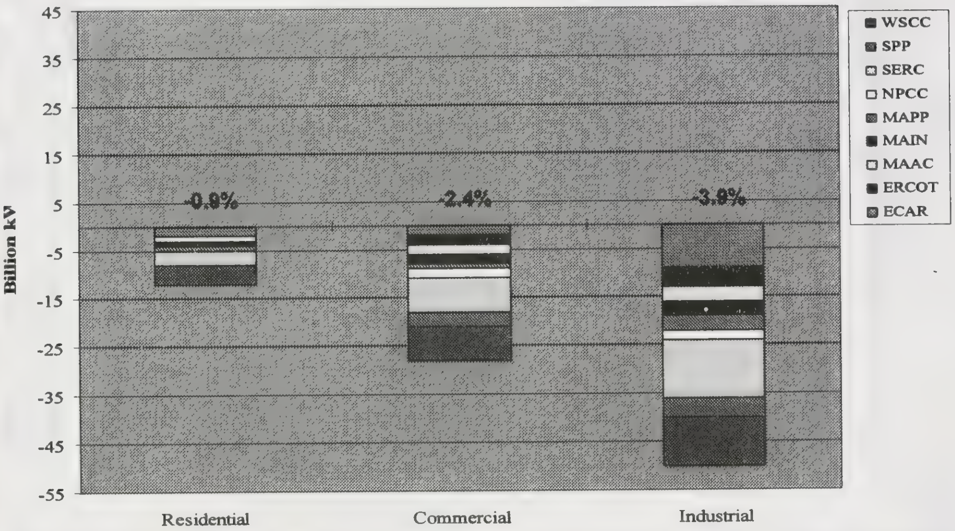
Changes in Regional Demand by Sector: Competitive Case Less Reference Case, 2010



APPENDIX B:

POEMS RESULTS FOR THE REFERENCE AND COMPETITIVE SCENARIOS

POEMS Results

Reference Case
from ref_98/d051398a

Total Energy Supply and Disposition Summary
(Quadrillion Btu per Year, Unless Otherwise Noted)

	2000	2005	2010
Production			
Crude Oil & Lease Condensate	12.38	11.55	11.39
Natural Gas Plant Liquids	2.69	3.02	3.08
Dry Natural Gas	21.54	22.62	24.63
Coal	22.95	24.84	26.42
Nuclear Power	7.14	6.60	5.87
Renewable Energy	6.50	6.85	7.17
Other	0.43	0.41	0.42
Total	73.62	75.88	78.99
Imports			
Crude Oil	19.13	20.71	21.43
Petroleum Products	5.13	6.68	7.86
Natural Gas	3.75	3.98	4.23
Other Imports	1.05	0.71	0.51
Total	29.05	32.08	34.03
Exports			
Petroleum	1.67	1.71	1.83
Natural Gas	0.21	0.21	0.22
Coal	2.44	2.59	2.82
Total	4.32	4.51	4.87
Discrepancy	0.14	-0.35	-0.22
Consumption			
Petroleum Products	38.46	40.60	42.28
Natural Gas	24.87	26.20	28.44
Coal	20.74	22.43	23.91
Nuclear Power	7.14	6.60	5.87
Renewable Energy	6.50	6.85	7.18
Other	0.79	0.43	0.24
Total	98.49	103.10	107.90
Net Imports - Petroleum	22.58	25.69	27.46
Resource Prices (1995 dollars per unit)			
World Oil Price ($ per bbl)	18.13	19.74	20.53
Gas Wellhead Price($ / Mcf)	1.90	1.91	1.90
Coal Minemouth Price ($ / ton)	18.16	17.30	16.40
Delivered Prices to Electric Generators (1995 $/MMBtu)			
Distillate Oil	4.55	4.79	4.93
Residual Oil	2.87	3.25	3.61
Natural Gas	2.32	2.28	2.24
Coal	1.29	1.23	1.18

POEMS Results

Reference Case
from ref_98/d051398a

Macroeconomic Indicators
(Billion 1992 Chain-Weighted Dollars, Unless Otherwise Noted)

	2000	2005	2010
GDP Implicit Price Deflator (index 1992=1.000)	1.217	1.411	1.667
Real Gross Domestic Product	7545	8390	9182
Real Consumption	5146	5673	6217
Real Investment	1212	1366	1487
Real Government Spending	1292	1364	1440
Real Domestic Product (1987 fixed-weighted dollars)	6492	7318	8143
Real Disposable Personal Income (1987 fixed-weighted dollars)	4599	5113	5643
Index of Manufacturing Gross Output (index 1987=1.000)	1.406	1.590	1.765
AA Utility Bond Rate (percent)	6.83	6.27	6.12
Real Utility Bond Rate (percent)	4.11	3.05	2.67
Population w/Armed Forces Overseas (millions of people)	275.6	287.1	298.9

POEMS Results

Reference Case
from ref_98/d051398a

National Electricity Results

	2000	2005	2010
Electricity Demand by Sector (BkWh)			
Residential	1,130	1,218	1,325
Commercial	1,023	1,094	1,164
Industrial	1,119	1,196	1,266
Transportation	8	25	43
Total	3,280	3,533	3,797
Generation by Ownership (BkWh)			
Utility	3,106	3,000	2,984
EWG	171	603	906
NonTraditional Cogen	78	34	30
Traditional Cogen	35	46	52
International Imports	76	39	17
Total	3,465	3,721	3,987
Generation by Fuel Type (BkWh) (excludes Traditional Cogen and Firm Imports)			
Coal	1,767	1,921	2,058
Gas	503	705	918
Oil	68	36	30
Hydro	295	298	298
Nuclear	668	618	550
Geothermal	17	17	19
Refuse	21	24	27
Wood Steam	10	11	11
Solar Thermal	1	1	2
Wind	5	7	9
Solar PV	0	0	1
Total	3,356	3,639	3,923
Renewable Cogeneration (BkWh)	44	48	52
Energy Consumption by Fuel Type and Total (Quads)			
Coal	18.06	19.75	21.21
Gas	4.97	5.83	7.12
Nuclear	7.18	6.64	5.91
Oil	0.69	0.37	0.32
Total	30.91	32.58	34.56
Capacity (MW) (including NonTraditional Cogen)			
Combined Cycle	39,133	78,362	114,095
Coal	307,949	316,324	322,530
Combustion Turbines	72,001	83,293	101,649
Fuel Cells	0	0	0
Hydro	79,757	80,025	79,914
Nuclear	97,121	86,983	76,610
Other Fossil	118,432	103,906	87,489
Pumped Storage	19,812	18,800	18,800
Geothermal	3,075	3,020	3,139
Refuse	3,234	3,675	4,195
Wood Steam	2,232	2,357	2,284
Solar Thermal	392	467	636
Wind	2,262	3,333	3,969
Solar PV	25	130	350
Total	745,424	780,675	815,660

POEMS Results

Reference Case
from ref_98/d051398a

	2000	2005	2010
Cumulative Retirements (MW)			
Combined Cycle	0	11,052	12,015
Coal	2,627	2,635	2,635
Combustion Turbines	4,565	4,865	4,865
Fuel Cells	0	0	0
Hydro	0	0	0
Nuclear	5,199	19,174	25,553
Other Fossil	23,940	43,736	52,557
Pumped Storage	0	1,012	1,012
Geothermal	0	179	238
Refuse	0	0	0
Wood Steam	0	73	73
Solar Thermal	0	0	0
Wind	0	0	0
Solar PV	0	0	0
Total	36,331	82,727	98,949
Cumulative Additions (MW)			
Combined Cycle	10,909	60,036	97,106
Coal	2,311	10,470	16,677
Combustion Turbines	13,940	25,571	43,928
Fuel Cells	0	0	0
Hydro	1,258	1,258	1,258
Nuclear	1,170	1,170	1,170
Other Fossil	0	0	0
Pumped Storage	0	0	0
Geothermal	5	64	302
Refuse	222	663	1,183
Wood Steam	66	66	66
Solar Thermal	20	90	260
Wind	10	876	1,511
Solar PV	0	100	320
Total	29,910	100,364	163,780
National Emissions (thousand short tons, except Carbon in million metric tons)			
Carbon	555	605	660
SO2	10,115	9,519	9,023
NOX	4,837	5,014	5,277
Volume of Electricity Trading (BkWh)			
Imports (economy)	139	120	140
Inter-regional	77	57	67
Intra-regional	62	63	73
Imports (firm)	76	39	17

POEMS Results

Reference Case
from ref_98/d051398a

Electricity Prices (Cost of Service)
(1995 Dollars/MWh)

	2000	2005	2010
Generation			
Residential	44.6	41.5	37.8
Commercial	43.4	40.3	36.5
Industrial	32.9	31.2	29.2
Transportation	21.9	22.3	22.1
Total	40.2	37.5	34.4
Transmission			
Residential	7.9	8.3	8.2
Commercial	5.8	6.2	6.1
Industrial	4.0	4.3	4.2
Transportation	8.1	8.5	8.0
Total	5.9	6.3	6.2
Distribution			
Residential	28.6	28.2	27.3
Commercial	18.0	17.7	17.4
Industrial	9.4	9.4	9.3
Transportation	27.9	27.6	27.0
Total	18.7	18.6	18.3
Total Delivered Prices			
Residential	81.1	78.1	73.3
Commercial	67.2	64.2	60.0
Industrial	46.3	44.9	42.7
Transportation	58.0	58.3	57.1
Total	64.8	62.4	58.8

POEMS Results

Competitive Case
from comp98/d050898a

Total Energy Supply and Disposition Summary
(Quadrillion Btu per Year, Unless Otherwise Noted)

	2000	2005	2010
Production			
Crude Oil & Lease Condensate	12.38	11.55	11.39
Natural Gas Plant Liquids	2.69	3.02	3.08
Dry Natural Gas	20.93	22.26	23.48
Coal	23.51	24.44	25.73
Nuclear Power	7.58	6.72	5.53
Renewable Energy	6.60	7.66	8.56
Other	0.43	0.41	0.42
Total	74.12	76.07	78.18
Imports			
Crude Oil	19.13	20.71	21.43
Petroleum Products	5.13	6.68	7.86
Natural Gas	3.75	3.98	4.23
Other Imports	1.05	0.71	0.52
Total	29.05	32.09	34.03
Exports			
Petroleum	1.67	1.71	1.83
Natural Gas	0.21	0.21	0.22
Coal	2.44	2.60	2.82
Total	4.32	4.52	4.87
Discrepancy	0.01	-0.38	-0.36
Consumption			
Petroleum Products	38.25	40.48	42.18
Natural Gas	24.29	25.84	27.29
Coal	21.34	22.12	23.18
Nuclear Power	7.58	6.72	5.53
Renewable Energy	6.60	7.67	8.56
Other	0.79	0.43	0.24
Total	98.85	103.30	107.00
Net Imports - Petroleum	22.58	25.69	27.46
Resource Prices (1995 dollars per unit)			
World Oil Price ($ per bbl)	18.13	19.74	20.53
Gas Wellhead Price($ / Mcf)	1.73	1.82	1.84
Coal Minemouth Price ($ / ton)	17.91	17.05	16.20
Delivered Prices to Electric Generators (1995 $/MMBtu)			
Distillate Oil	4.55	4.78	4.93
Residual Oil	2.86	3.33	3.67
Natural Gas	2.14	2.19	2.16
Coal	1.29	1.23	1.19

Note: these runs did not include the international or petroleum modules. The petroleum production, import and resource price projections remain at their Reference Case values.

POEMS Results

Competitive Case
from comp98/d050898a

Macroeconomic Indicators
(Billion 1992 Chain-Weighted Dollars, Unless Otherwise Noted)

	2000	2005	2010
GDP Implicit Price Deflator (index 1992=1.000)	1.217	1.411	1.667
Real Gross Domestic Product	7545	8390	9182
Real Consumption	5146	5673	6217
Real Investment	1212	1366	1487
Real Government Spending	1292	1364	1440
Real Domestic Product (1987 fixed-weighted dollars)	6492	7318	8143
Real Disposable Personal Income (1987 fixed-weighted dollars)	4599	5113	5643
Index of Manufacturing Gross Output (index 1987=1.000)	1.406	1.590	1.765
AA Utility Bond Rate (percent)	6.83	6.27	6.12
Real Utility Bond Rate (percent)	4.11	3.05	2.67
Population w/Armed Forces Overseas (millions of people)	275.6	287.1	298.9

POEMS Results

Competitive Case
from comp98/d050898a

National Electricity Results

	2000	2005	2010
Electricity Demand by Sector (BkWh)			
Residential	1,155	1,227	1,311
Commercial	1,033	1,089	1,136
Industrial	1,121	1,177	1,217
Transportation	8	25	41
Total	3,317	3,518	3,705
Generation by Ownership (BkWh)			
Utility	3,161	3,037	3,016
EWG	155	518	748
NonTraditional Cogen	78	71	66
Traditional Cogen	34	41	45
International Imports	76	39	17
Total	3,503	3,706	3,891
Generation by Fuel Type (BkWh) (excludes Traditional Cogen and Firm Imports)			
Coal	1,840	1,936	2,075
Gas	437	604	724
Oil	53	27	25
Hydro	296	301	305
Nuclear	710	630	517
Geothermal	17	19	21
Refuse	21	24	27
Wood Steam	10	41	70
Solar Thermal	2	2	3
Wind	12	45	68
Solar PV	0	0	1
Total	3,398	3,631	3,835
Renewable Cogeneration (BkWh)	44	48	52
Energy Consumption by Fuel Type and Total (Quads)			
Coal	18.73	19.47	20.52
Gas	4.36	5.10	5.75
Nuclear	7.62	6.76	5.56
Oil	0.54	0.28	0.26
Total	31.26	31.61	32.09
Capacity (MW) (including NonTraditional Cogen)			
Combined Cycle	35,363	70,777	90,213
Coal	310,608	313,884	316,637
Combustion Turbines	68,301	87,147	100,450
Fuel Cells	0	0	0
Hydro	79,757	80,025	79,914
Nuclear	97,121	85,918	71,011
Other Fossil	122,141	118,300	101,732
Pumped Storage	19,812	19,498	19,498
Geothermal	3,078	3,348	3,673
Refuse	3,234	3,674	4,195
Wood Steam	2,232	6,902	11,171
Solar Thermal	668	761	931
Wind	5,559	19,774	28,776
Solar PV	25	130	350
Total	747,899	810,137	828,551

POEMS Results

Competitive Case
from comp98/d050898a

	2000	2005	2010
Cumulative Retirements (MW)			
Combined Cycle	0	1,279	2,202
Coal	0	0	0
Combustion Turbines	4,691	4,747	4,834
Fuel Cells	0	0	0
Hydro	0	0	0
Nuclear	5,199	22,323	30,684
Other Fossil	18,335	26,237	39,366
Pumped Storage	0	314	314
Geothermal	0	0	0
Refuse	0	0	0
Wood Steam	0	0	0
Solar Thermal	0	0	0
Wind	0	0	0
Solar PV	0	0	0
Total	28,225	54,900	77,400
Cumulative Additions (MW)			
Combined Cycle	7,139	43,626	63,984
Coal	2,311	5,364	8,117
Combustion Turbines	10,436	29,338	42,734
Fuel Cells	0	0	0
Hydro	1,258	1,258	1,258
Nuclear	1,170	1,170	1,170
Other Fossil	0	0	0
Pumped Storage	0	0	0
Geothermal	8	273	599
Refuse	222	663	1,183
Wood Steam	66	4,610	8,880
Solar Thermal	296	384	554
Wind	3,307	17,317	26,319
Solar PV	0	100	320
Total	26,213	104,103	155,118
National Emissions (thousand short tons, except Carbon in million metric tons)			
Carbon	561	585	621
SO2	10,561	9,684	9,211
NOX	4,868	4,843	5,047
Volume of Electricity Trading (BkWh)			
Imports (economy)	221	199	209
Inter-regional	107	78	86
Intra-regional	113	121	123
Imports (firm)	76	39	17

POEMS Results

Competitive Case
from comp98/d050898a

Electricity Prices (Competitive)
(1995 Dollars/MWh)

	2000	2005	2010
National Marginal Price of Generation			
Residential	25.2	25.3	24.9
Commercial	26.4	26.5	26.0
Industrial	23.7	24.1	23.8
Transportation	23.1	22.6	21.3
Total	25.1	25.3	24.8
Stranded Costs			
Generating			
Residential	3.7	3.0	2.4
Commercial	3.3	2.7	2.1
Industrial	2.1	1.7	1.3
Transportation	0.2	0.2	0.2
Total	3.0	2.4	1.9
Regulatory			
Residential	0.8	0.7	0.5
Commercial	0.7	0.6	0.5
Industrial	0.5	0.4	0.3
Transportation	0.0	0.0	0.0
Total	0.7	0.6	0.4
Other Cost Considerations			
Decomissioning			
Residential	1.2	0.9	0.7
Commercial	1.1	0.9	0.7
Industrial	0.7	0.6	0.4
Transportation	0.1	0.1	0.1
Total	1.0	0.8	0.6
Renewable Portfolio Standard Premium			
Residential	0.0	0.8	1.0
Commercial	0.0	0.8	1.0
Industrial	0.0	0.8	1.0
Transportation	0.0	0.8	1.0
Total	0.0	0.8	1.0
Ancillary Services			
Residential	1.3	2.0	2.2
Commercial	1.3	2.0	2.2
Industrial	1.2	1.9	2.0
Transportation	1.3	1.8	2.0
Total	1.3	1.9	2.1
Final Delivered Prices			
Generation			
Residential	32.2	32.7	31.7
Commercial	32.9	33.4	32.4
Industrial	28.2	29.5	29.0
Transportation	24.8	25.6	24.6
Total	31.1	31.8	30.9
Transmission			
Residential	7.8	7.6	7.1
Commercial	5.8	5.6	5.2
Industrial	4.0	3.8	3.7
Transportation	8.0	7.4	7.0
Total	5.9	5.7	5.4

	POEMS Results			**Competitive Case** from comp98/d050898a
Distribution				
Residential	28.4	26.0	23.4	
Commercial	17.8	16.2	14.7	
Industrial	9.3	8.6	7.9	
Transportation	27.7	25.2	22.9	
Total	18.7	17.1	15.7	
Total Delivered Prices				
Residential	68.4	66.2	62.3	
Commercial	56.5	55.2	52.3	
Industrial	41.4	41.9	40.6	
Transportation	60.5	58.2	54.6	
Total	55.6	54.6	52.0	

Stranded Generating Assets - Net at Company Level (Billion 1995 Dollars)

	Surplus*	Stranded
National Total	66.89	-85.39

* Not adjusted for Preference Power pricing (so overstates surplus)

APPENDIX C:

POTENTIAL COST SAVINGS FROM ELECTRICITY COMPETITION:

BEST PRACTICES ANALYSIS

APPENDIX C:

POTENTIAL COST SAVINGS FROM ELECTRICITY COMPETITION

Summary:

This paper quantifies potential savings opportunities in four areas: cost reduction (including fuel procurement, non-fuel operation and maintenance (O&M) expenses, and administrative and general (A&G) expenses), dispatch efficiency, improved capital utilization, and savings in capital additions. Table 1 summarizes these potential savings.

Table 1
Summary of Cost Savings Potential from Competition

Source of Savings	Potential Size of Benefit (billions of $)
Cost Reduction (Fuel, non-fuel O&M, A&G)	$24.6
Dispatch Efficiency	$0.6
Improved Capital Utilization	$0.8 to $2.6
Reduced Capital Additions	$0.3 to $3.8
TOTAL	$26.3-31.6

Several sources of important additional savings are not considered in this paper.

First, as pricing becomes more efficient, load shape adjustments from consumers on the demand side of the meter can reduce the need to add expensive new capacity that would otherwise be necessary to meet peak demands of only a few hours duration per year. A recent study of the New York State power pool suggests that savings in that one area alone could reach $660 million annually by 2010.

Second, our cost analysis assumes that regulators and firms would not repeat past mistakes with respect to capacity planning, choice of technology, or project management that have raised the cost of power to consumers. While regulators have undoubtedly learned from past events, future regulation is unlikely to be perfect.

Finally, experience in other sectors suggests that competition will lead to the creation of new product combinations with greater economic value to consumers. Our estimates do not reflect this benefit at all.

The remainder of this paper provides detail on the four categories of potential savings summarized in Table 1.

1. Fuel Costs, Non-Fuel Operation and Maintenance (O&M) Costs, and Administrative and General (A&G) Costs

Fuel Costs, Non-Fuel O&M Costs, and A&G Costs, which together accounted for roughly $94 billion in reported utility cost in 1995, largely reflect the current operations of electric utilities. (Note: A portion of A&G costs also reflect historical operations to the extent that pension liabilities have not been funded on a current basis.)

Information reported in standard industry filings suggests a wide range of cost experience across reporting units and companies. These data can be used to gain insight into opportunities for cost reduction. Our approach here is to estimate the value of bringing the cost performance of the entire industry up to the standard already demonstrated by top industry performers -- represented in this paper as the average of the top quartile of reported performance.

Some of the difference in cost experience clearly reflects circumstances that will not be changed by the advent of competition. For example, coal prices differ according to the distance from low-cost coal supplies; heat rates reflect the vintage, type, scale, and operating rate of plants and pollution control requirements; and distribution costs are systematically related to the density of customers on a system. To account for such factors, the reported data is stratified along key dimensions prior to developing the quartile analysis. Stratification (details reported in Appendix) narrows the range of cost variation, but significant differences remain, as reported in Table 2.

Table 2
Cost-Reduction Opportunities

Category	Potential Savings (billions of 1996 dollars)
Fuel Acquisition	$6.7
Heat Rates	$0.9
Non-fuel Operation and Maintenance	$11.0
Administrative and General	$6.0
TOTAL	$24.6

The reported total of $24.6 billion in cost-saving potential could either underestimate or overestimate actual cost reduction opportunities. On the underestimation side, top quartile performance under regulation may understate achievable efficiencies under competition as even the best current performers re-engineer and rethink their activities. Moreover, the lack of data for existing non-utility generators, who are widely believed to be among the most cost-effective operators, could lead to some underestimate of even the current state-of-the-art efficiencies. On the overestimation side, the stratification underlying the quartiles reported in Table 2 for fuel and O&M costs may fail to account for all sources of irreducible cost differences. Moreover, the portion of the variation in cost across plants that reflects contract cycles for fuel and other inputs could be expected to narrow over time independent of the advent of competition.

2. Dispatch Efficiencies

Competition is likely to result in improved dispatch efficiencies. The advent of competition will shift the market from a "shared savings" paradigm to one in which the party that identifies a cost-effective trade can reap the benefits, providing dispatch efficiencies beyond those that might result from wholesale competition alone. Analyses using the Policy Office Electricity Modeling System (POEMS) suggest that dispatch efficiencies resulting from retail competition can reduce aggregate system fuel costs by approximately $600 million relative to a scenario reflecting a continued cost-of-service regime.

3. More Efficient Utilization of Capital.

The generation, transmission, and distribution of electricity are among the most capital-intensive activities in the U.S. Yet, the relatively inflexible price signals provided to consumers under traditional cost-of-service regulation have resulted in relatively poor utilization of our substantial investment in electricity-related capital. Retail competition will allow electricity markets to emulate the experience of airlines and communications providers in implementing load-sensitive pricing regimes (such as 5 cents per minute calls on Sundays), allowing the additional use of electricity in price sensitive applications during off-peak and off-season periods.

Ideally, the gains from more efficient capital utilization would be calculated separately for each load segment in each season. However, absent estimates of segment-specific demand responses to price variation, the impacts of competition on average prices can be used to develop a rough estimate of capital utilization benefits. Model results and recent experience with restructuring at the state level suggest that average delivered prices in a restructured industry will average 6 to 9 mills (9 to 13 percent) lower than prices projected under continued cost-of-service regulation, depending upon what provisions are made for stranded cost recovery. Using an estimate of -.1 to -.2 for the price elasticity (the percentage change in demand resulting from a 1% increase in price), the 9 to 13 percent price drop translates into an increase of between 0.9 and 2.6 percent in electricity sales.

The net welfare benefit from these extra sales includes two components. First, there is additional "consumer surplus" which reflects the extent to which the value of the extra electricity to buyers exceeds its price. Second, since extra sales under load-sensitive market pricing do not increase transmission or distribution system costs or stranded costs, any transmission, distribution, or stranded cost charges on these sales are also a net welfare gain. In 1995, the national average for transmission and distribution was 2.38 cents per kilowatt-hour. For a level of baseline demand of 3,250 billion kilowatthours, the estimated net welfare gain from more intensive capital utilization is estimated to fall between $820 million and $2.6 billion.

It is important to note that the estimates in this section focus narrowly on the more efficient use of the baseline capital stock and do not include an estimate of the substantial benefit of more nimble pricing in curtailing peaks that often necessitate the addition of expensive new capacity.

4. Reduced Capital Costs at Existing Plants

Capital additions at existing plants are another area where available data suggest a considerable range of experience across utilities. However, the analysis of such additions can be quite complex. First, a considerable portion of the observed variation in the cost of capital additions per unit of capacity can often result from environmental or nuclear regulatory decisions or determinations affecting specific units that would not be sensitive to the shift to a more competitive regime. Second, capital additions occur at irregularly spaced intervals, and many plants will have no significant capital additions in a particular year.

To address the issue of irregularly-spaced capital additions, we focused on average capital additions over a decade rather than additions in a single year. Over the 1985 to 1995 period, reported capital additions at existing power plants averaged approximately $6.3 billion per year, with average additions of $3.1 billion at nuclear plants, $2.6 billion at coal fired plants, and $0.6 billion at oil and gas steam plants.

For present purposes, the most interesting comparisons can be made within the set of coal plants commissioned after 1965 that were operating without scrubbers or NOx controls at the end of the sample period. Capital additions at these plants would not reflect the costs of repowering, emissions control requirements, or nuclear regulation. Assuming that the average of the top quartile of reporting units reflects the typical standard of performance in competitive markets, annual cost savings opportunities relative to actual reported costs for capacity additions within this relatively homogeneous subgroup of coal plants are estimated at $274 million out of $468 million. The application of quartile analysis to the capital additions data for the stratified sample of all plants of all fuel types suggests an overall potential savings of $3.8 billion, but this is likely to be a significant overestimate for reasons outlined above. The real potential for cost-savings in capital additions likely lies in the lower portion of the range of $0.3 to $3.8 billion.

APPENDIX D:

POEMS DOCUMENTATION

ONLOC-98-03

Policy Office
Electricity Modeling System (POEMS)
Model Documentation

In support of the Department of Energy's
Comprehensive Electricity Competition Plan

June 1998

Prepared By
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Policy Office Electricity Modeling System (POEMS) Model Documentation

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Policy Office Electricity Modeling System (POEMS) Model Documentation

Introduction

This paper documents POEMS, which integrates the Energy Information Administration's National Energy Modeling System (NEMS) with the more detailed electricity market model, TRADELEC™, developed by OnLocation, Inc.

POEMS

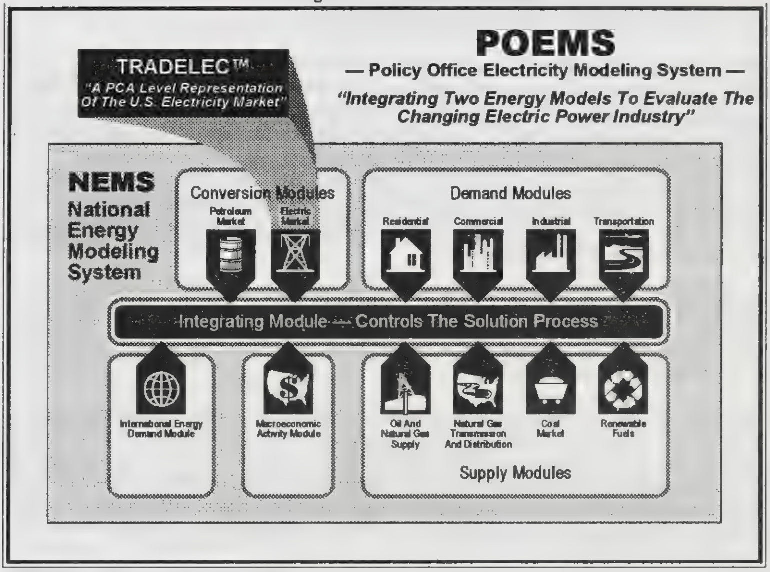
POEMS is a system that integrates two existing models, the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and TRADELEC™, a detailed competitive electricity market model addressing alternative market (i.e., pricing) mechanisms ranging from traditional cost-of-service rate regulation, performance-based rate-setting, and market rates; including the impact of increased trading of electricity, associated network power flows, and resulting capacity utilization (dispatch).

NEMS is an energy-economy modeling system of U.S. energy markets. NEMS provides projections of the production, imports, conversion, consumption, and prices of energy subject to assumptions regarding macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological cost criteria, cost and performance characteristics of energy technologies, and demographics. NEMS is used to develop the baseline energy forecasts published annually by EIA in the Annual Energy Outlook. It can also be used as a tool for energy policy analysis related to existing and proposed changes in a wide variety of laws and regulations related to energy production and use, environmental protection, environmental requirements, or tax provisions. Documentation of NEMS is available from EIA.

NEMS is modular in structure. (See Figure 1) On the supply side, there are separate modules for oil and gas supply, gas transmission, coal markets, and renewable fuels. On the demand side, each end-use sector (residential, commercial, industrial, and transportation) is represented, with inter-fuel competition to meet end-use demands as appropriate. The electricity supply and distribution and petroleum refining sectors are classified as conversion modules. An integrating module interacts with all three categories of modules described above, together with modules representing the macro-economy and international energy markets. The integrating module controls the solution process, iterating the individual models until convergence representing equilibrium in the producing and consuming sectors is achieved.

Policy Office Electricity Modeling System (POEMS) Model Documentation

Figure 1: Overview of POEMS


TRADELEC™
"A PCA Level Representation Of The U.S. Electricity Market"
POEMS
— Policy Office Electricity Modeling System —
"Integrating Two Energy Models To Evaluate The Changing Electric Power Industry"
NEMS
National Energy Modeling System
Conversion Modules
Petroleum Market
Electric Market
Demand Modules
Residential
Commercial
Industrial
Transportation
Integrating Module — Controls The Solution Process
International Energy Demand Module
Macroeconomic Activity Module
Oil And Natural Gas Supply
Natural Gas Transmission And Distribution
Coal Market
Renewable Fuels
Supply Modules

The design requirement to run all of the modules to equilibrium together constrains the level of detail provided in each NEMS module. While recognizing the advantages of the NEMS system, POEMS is more narrowly aimed at addressing questions surrounding electricity markets. For this purpose, there are significant advantages to a more disaggregated representation of the electricity sector. The approach taken in POEMS is to substitute TRADELEC™ for the electricity market module (EMM) in NEMS. Depending on the focus of the analysis, TRADELEC™ is run in conjunction with a relevant subset of NEMS modules, such as the various demand modules and the natural gas modules.

TRADELEC ™

Because of the importance of the electric power industry to the US economy and the engineering relationships that exist for the processes that convert primary fuels to electricity, detailed models of the power industry have long been used to help focus operational and policy insights. One hallmark of these models was detailed treatment of the computations needed to calculate historical embedded cost-of-service prices. As regulation changes, these models are revised and extended to capture new events. The reorganization of the electric industry to include competitive generation markets will eventually simplify this modeling task. Electricity prices will be determined by market forces based on the intersection of supply and demand, and most of the time generation prices will be equal to the marginal costs of the most expensive generator operating at that time. During periods of excess demand [1], prices will rise to ration the available supply among the buyers.

However, during the transition period there are good reasons to model both the old and the new regimes. Modeling allows the examination of both regimes under controlled 'laboratory-like' conditions before the actual transition takes place. Additionally, one major transition cost, the excess of book value over market value, commonly referred to as stranded assets, will be determined by the difference between the new market prices and the old, regulated prices. Scoping out the size of the stranded asset problem and testing various recovery mechanisms becomes a central area of interest. Therefore, there is much current interest in comparing prices under both systems and in studying how these price differences change as policies toward restructuring are modified. POEMS allows policy-makers and legislators to quantitatively assess the implications of deregulation on ratepayers, shareholders, bondholders, and taxpayers.

OnLocation, Inc., has incorporated the TRADELEC™ model into NEMS to assist the Department of Energy's Office of Economic, Electricity, and Natural Gas Analysis better study the transformation of the electric power industry and to provide insights into the functioning of electricity and energy markets as part of the economy in the restructured environment.

The heart of the TRADELEC™ model is market driven electricity trade over the existing electric transmission system. Electricity trade is solved for as a function of relative prices, transmission availability and a hurdle rate that is designed to reflect the additional costs of handling market trading. TRADELEC™ represents transmission interties at existing transfer interfaces based on data reported at the power control area (PCA) level. Current and future bottlenecks may limit trade flows among certain buyers and sellers when transmission capacity is reached. This would result in final regional price differences that exceed the cost of transmission and trading.

This trading function is critical in determining competitive prices for electric power and in measuring any efficiency gains from restructuring the electric industry. By explicitly solving trade relationships, the model allows insights into pricing patterns and the motivation for interregional trading.

Network interregional trade is solved to maximize the economic gains from trade by ordering the trades in descending order starting with the trade that contributes the largest efficiency gains first. Succeeding trades continue until available transmission opportunities or all the possible gains are exhausted. The primary economic and physical limits to trade are imposed via alternative scenarios of transmission fees, losses, transmission capacity, and hurdle rates. Thus, integrated interregional trade is modeled to operate in much the same fashion as a full fledged, time-block power auction could operate.

In the absence of transmission constraints, electricity prices nationwide would converge to a single value with local delivery prices varying only by differences in the cost of transmission (including line losses) and distribution services. However, the tendency in competitive markets toward a single price does not mean that there will be no market separation. Because transmission is neither unconstrained nor without cost, separable regional electricity markets are likely to be observed as model solutions evolve. Additional regional constraints, such as regional specific pollution abatement measures could further increase regional price differences even with fully competitive power markets.

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[1] By definition, the demand for electricity cannot exceed supply; but situations where consumers may want more power than the system can deliver are possible. When this situation arises, demand must be cut back to the available supply. With cost-of-service regulation this is accomplished by using voltage reductions, rolling blackouts or some other administrative approach. In competitive markets, prices will rise until consumers reduce demand and/or producers increase supply until the two equate.

Policy Office Electricity Modeling System (POEMS) Model Documentation

Model Description and Structural Assumptions

Demand/Load

Electricity demand information is drawn from the NEMS system by customer class and end-use or industrial type (e.g. commercial lighting or paper industry electricity use) at the census region level. Each of these end-uses or industries is assigned a distinct load shape. For weather sensitive demands, the load shapes vary by region as well. In each future year, the end-use load shapes are added together and then the loads are allocated to individual PCA's based on the historical proportion of sales (i.e., load) within each power control area in each larger region.

A unique aspect of the POEMS model, which it shares with the NEMS electricity sector, is the representation of the load duration curves with vertical, rather than horizontal, time blocks. For most applications, loads are represented by 2 segments within 6 daily time blocks within each of 6 seasons, although these can be varied by the user. Except for one peak segment, each segment within each season represents the average load in that time block.

Dispatch/Trade

TRADELEC™ is a network model of electricity dispatch, trade, capacity expansion and pricing (see Figure 2). The POEMS version of the model operates at the level of the power control area (PCA), representing approximately 114 regions (Figure 3). PCAs are represented as a series of nodes, connected by transmission interties whose capacities are specified based on transfer capabilities reported to FERC. There are over 650 transmission links in POEMS. New transmission additions are limited to maintenance and those associated with the construction of new generating assets. Within each PCA, supply resources are represented in considerable detail, including utility plants, exempt wholesale generators, traditional and non-traditional cogenerators, and firm power contracts. Although usually existing firm power wholesale contracts for generation or capacity are assumed unabrogated, a user option is available for canceling these contracts. Plant characteristics, such as capacity, heat rate, and forced and maintenance outage rates, are represented based on data in EIA filings and NERC GADS data.[2] TRADELEC™ incorporates financial, operational, and physical data representing virtually every significant operating electric utility in the USA and the transmission interties among them.

Each unit in the plant input file is combined with like units to form dispatchable groups. The process of combining units is flexible, but at a minimum, combined units serve the same demand region and are physically located in the same supply region, use the same fuels with the same type of prime mover and have the same in-service period. Dispatchable capacity groups also have similar heat rates and renewable groups have similar utilization patterns. Currently, there are over 6,000 plant groupings used in the model. There are 55 dispatchable plant groupings per PCA on average, with larger PCAs having as many as 350 plant groups. A merit order dispatch algorithm is initially employed to determine generation in each time segment prior to trade.

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[2] NERC Generating Availability Data System

Figure 2: TRADELEC Electricity Market Module

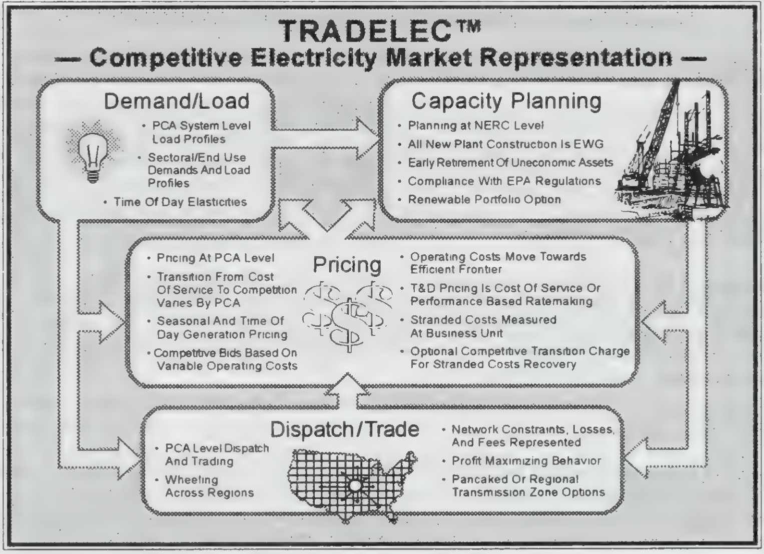
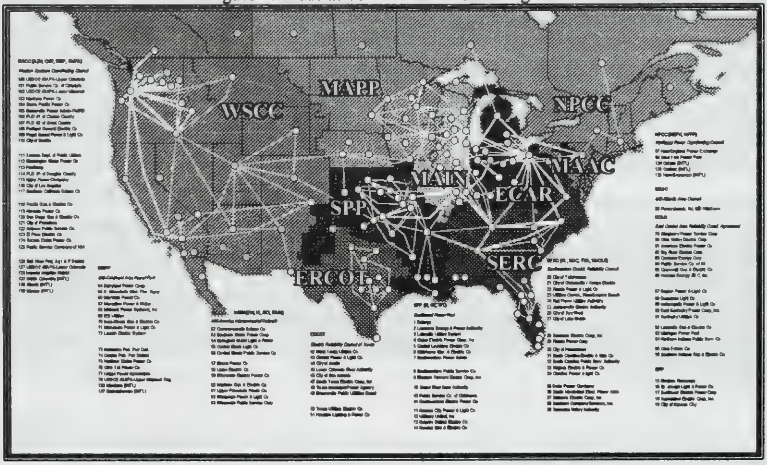

TRADELEC™
— Competitive Electricity Market Representation —
Demand/Load
• PCA System Level Load Profiles
• Sectoral/End Use Demands And Load Profiles
• Time Of Day Elasticities
Capacity Planning
• Planning at NERC Level
• All New Plant Construction Is EWG
• Early Retirement Of Uneconomic Assets
• Compliance With EPA Regulations
• Renewable Portfolio Option
Pricing
• Pricing At PCA Level
• Transition From Cost Of Service To Competition Varies By PCA
• Seasonal And Time Of Day Generation Pricing
• Competitive Bids Based On Variable Operating Costs
• Operating Costs Move Towards Efficient Frontier
• T&D Pricing Is Cost Of Service Or Performance Based Ratemaking
• Stranded Costs Measured At Business Unit
• Optional Competitive Transition Charge For Stranded Costs Recovery
Dispatch/Trade
• PCA Level Dispatch And Trading
• Wheeling Across Regions
• Network Constraints, Losses, And Fees Represented
• Profit Maximizing Behavior
• Pancaked Or Regional Transmission Zone Options

Figure 3: Illustrative TRADELEC™ Regional Detail



Policy Office Electricity Modeling System (POEMS) Model Documentation

Transmission capacity is measured on a first contingency basis consistent with the established NERC rules. Transmission charges are calculated on approximations of straight-line, simultaneously available paths to project the volume and costs of electricity trade. Transmission costs are reflected through representation of transmission tariffs (which can be implemented on a PCA or regional level) and transmission losses (a non-linear, distance sensitive measure). Further, a user specified "hurdle level" is input to limit transactions to those that provide a specified minimum level economic gain. The hurdle rate can be adjusted to reflect reductions in potential inefficiencies and transactions costs as markets provide greater incentives to exploit profitable trades. The market simulation is conducted within each of the 72 time/season blocks modeled - maintaining the chronological simultaneity.

Capacity Planning

In addition to dispatching existing capacity and trading among regions, the need for new capacity additions is calculated. The capacity planning methodology is similar to that of the NEMS electricity sector except that it is assumed that no new capacity additions will be rate-based by utilities in a competitive market scenario. Rather, the construction of all new facilities is profit motivated based on anticipated demand growth and competitive cost conditions caused by capacity shortages. Because of the higher risk associated with an unregulated market, the cost of capital is assumed to be higher than historical values for the industry. In a cost-of-service case, all new capacity is assumed to be constructed by Exempt Wholesale Generators (EWGs) which sell under long-term contracts to utilities. Capacity planning occurs at the NERC regional level, and new plants are allocated to individual PCAs based on their relative prices, system loads, and shortfall of capacity (if any).

The choice of new technology selection for new capacity is the same as in the NEMS electricity sector. The expansion algorithm minimizes the expected cost of meeting anticipated future load. In order to reflect that there will be site specific differences in costs within a planning region, the model includes a logit-based sharing mechanism. In this way technologies that were slightly more expensive will receive some market share. The TRADELEC™ capacity planning module also includes a feature that allows goals for renewable builds to be specified exogenously.

One aspect of POEMS that distinguishes it from NEMS and other models is its explicit treatment of economic retirements. Retirements of existing capacity occur when plant operating costs cannot be recovered through market-based prices. For some plants, there are some "forced" retirements determined exogenously in addition to economic retirements. No nuclear plants are assumed to continue operating after the end of their 40-year operating licenses. In addition, some nuclear plants are assumed to retire sooner, based on an analysis performed by EIA for the AEO98 identifying plants that "are among the first generation of plants to come on line, and generally have high operating costs, or have not made equipment repairs ... which are likely to be required for extended operation."[3]

The economic retirement decision for all generating plants is based on both short-term and long-term criteria. The short-term requirement is that plants can cover their "going-forward" costs, which includes all O&M costs and annual capital additions, by the revenue they receive through the marginal cost (MCP) in the wholesale market. If a plant cannot cover these costs, it becomes a candidate for early retirement. The second consideration is the cost of building new generating capacity. In the capacity planning module, all existing units must pay their going-forward costs if the capacity is to be used over the full planning horizon. Thus the planning module has the opportunity to economically retire any or all of the existing units and instead build new capacity. If the planning module does decide to economically retire a unit and this same unit did not cover its variable costs in the last forecast year, it is retired. A plant must be uneconomic in both the short-term and long-term to be retired.

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[3] EIA, Assumptions to the Annual Energy Outlook 1998

Pricing

TRADELEC™ can represent either cost-of-service or competitive pricing[4] in retail markets. The cost-of-service pricing reflects financial information aggregated from filings made by investor-owned, public, federal, and cooperatively-owned utilities.[5] Competitive rates are based on unbundled time-specific generation prices, and transmission and distribution prices. These latter are assumed to remain cost-of-service or can be set to reflect Performance Based Ratemaking, where an incentive is included to reduce costs.

Another distinguishing feature of the POEMS model is its flexible internal treatment of stranded costs in its pricing through the transition period. The competitive generation price is composed of the marginal cost, ancillary charges, a renewable portfolio standard (RPS) premium (if applicable), and stranded costs: decommissioning, regulatory assets, and generating assets. Marginal generation prices are set in each power control area (PCA) based on the marginal cost or bid price of the last unit running in each of 72 time slices. The last unit could be native to the PCA or determined through trade with other PCA's. The competitive bid price for each unit is assumed to be its marginal cost in accord with the standard characterization of perfectly competitive markets. The marginal costs are the sum of the fuel costs and the variable portion of operating and maintenance (O&M) costs.

The historical distinction between fixed and variable O&M costs is quite arbitrary, thus the POEMS initially puts all O&M costs into a fixed O&M account and allows the user to determine how much of the fixed costs should be considered variable. In addition, historical O&M costs are expected to be reduced over time due to the pressures of competition. The POEMS includes a feature that allows the user to specify O&M targets by plant type, and percentage cost reduction by plant type and year. (Competitive pressures are also expected to spill over into the regulated segment of the industry. The POEMS also allows the user to specify transmission and distribution productivity improvements). Competition is also expected to result in heat rate improvements, which affect the generation price. POEMS includes a feature that allows the user to specify target heat rates by plant type and percentage improvements by plant type and year.

Ancillary charges are assumed to be paid by Independent System Operators (ISOs) in competitive scenarios to generators in order to maintain system reliability. The total expenditures are determined by the amount of revenue that owners of new peaking capacity need in addition to the market bid price in order to cover all their costs (including fixed costs). Because of reserve margin requirements, some plants will be constructed that will not operate very much, if at all, but are needed for reliability. This additional revenue is then paid on a dollar per kilowatt-year basis to all combustion turbines and combined cycle plants in the region. Because the markets are competitive, the ISO's must pay all units the same amount and cannot discriminate between new and existing plants. The combustion turbines and combined cycle plants are the only ones that receive the payment because they can most readily be called on for quick startup reserve purposes.

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[4] While TRADELEC™ can estimate competitive prices under alternative approaches, the competitive pricing in POEMS is implemented as a second-price auction.

[5] The information is drawn from federal filings including FERC Form 1, EIA Form 412 and RUS Forms 7 and 12.

The renewable portfolio standard (RPS) is a feature that can be imposed on a competitive scenario as a minimum share of generation that must be met by non-hydro renewable resources. These include wind, biomass, solar thermal, solar PV, and geothermal. Because the renewable credits can be traded, the RPS is a national goal. Assuming the effect of a nationwide auction, the most expensive unit needed is the one that sets the price. In this case the price includes capital cost recovery. The total cost of the RPS equals the marginal renewable cost on a dollar per kilowatt-hour basis times the total renewable generation in each year. It is assumed to be charged equally to all customers in all regions of the country.

Stranded generation assets are those that have remaining capital costs that cannot be recovered through competitive prices. The stranded costs are computed at the company level, where each company's assets with below market costs offset those that are above market. In the POEMS Competitive case, recovery of these costs is set by the user by specifying the percentage of recovery, recovery period, discount rate, and start year of recovery. In addition, the user also sets the allocation method for recovery by customer class.

The relationship between competitive and cost-of-service prices will not be uniform across PCAs. Indeed, it is possible that competitive prices (on average) will exceed cost-of-service prices in areas with low embedded costs. The relationship between competitive and cost-of-service prices is a primary focus of attention in the restructuring debate, and the likely variation in this relationship across PCAs highlights the value of modeling at a disaggregated level. Disaggregation also allows for an evaluation of a piecemeal implementation of restructuring, which is of considerable interest to some policymakers. Piecemeal implementation allows competition to be initiated in different years for individual PCAs.

Additional Structural Assumptions

By its structure and its use for policy analysis, POEMS contains either implicitly or explicitly many assumptions of how a competitive market for electricity will evolve. The most fundamental assumption is that all activities will be economically motivated and be driven by profit maximizing or cost minimizing behavior. In addition to the structural assumptions, there are several parameters that can be specified by the user in order to represent alternative scenarios of restructuring. The following table includes a list of both the structural and scenario-type assumptions in POEMS.

Policy Office Electricity Modeling System (POEMS) Model Documentation

POEMS Assumptions

Basic Structure:

- Initial generation, transmission and distribution assets reflect best available data
- Regional representation includes 114 Power Control Areas (PCAs) and 680 transmission links
- New transmission additions are limited to maintenance and those associated with the construction of new generating units
- Power dispatch and trading occurs for 2 segments within 6 daily time blocks in each of 6 seasons of the year (total of 72)
- Transmission and distribution continue to be regulated services, but can be incentive driven
- Demand levels and load shapes are dynamic modifications of historical record
- Existing legislation remains in place, for example, the Clean Air Act
- Macroeconomic and fuel price forecasts is consistent with EIA's Annual Energy Outlook

Competitive Scenario:

- All activities are economically motivated; driven by profit maximizing/cost minimizing behavior
- All generation, transmission & distribution activities are unbundled
- Electricity prices are based on the value of power plus transmission, trading and distribution costs
- Generators have no market power
- All consumers have direct market access and full contemporaneous information
- Transmission charges are calculated by applying a FERC Order 888 type formula
- Inter-regional trading clears markets in each time block, constrained by limited transmission capacity
- New generating capacity additions and retirements are profit motivated
- No new generation capacity is rate-based

Scenario Options (User Specified):

- Consumer price approach
  - PCA-level average embedded cost or market-area value priced
  - continuing historical cross class price subsidies or same time-specific generation price to all classes of customers
  - transmission and distribution pricing cost-of-service or incentive driven
- Existing long-term wholesale contracts for generation or capacity usually assumed unabrogated, but can be canceled
- Competitive rates can be phased-in both over time and geographically
- Alternative user-specified competitive transition charges (CTC) for stranded cost recovery
- Alternative formulas for transmission charges
- Renewable portfolio standard option
- Additional optional settings include but are not limited to changing the fraction of non-fuel operating costs that are considered to be variable; increasing the risk premium on interest rates; imposing a competitive transaction hurdle charge on trades; and reducing O&M costs and heat rates to represent heightened competitive pressures

Policy Office Electricity Modeling System (POEMS) Model Documentation

Model Inputs and Data Assumptions

TRADELEC™ inputs include some that are completely exogenous to the model, and some that are passed from other NEMS models. Data passed from other NEMS models include sectoral electricity demands, fuel prices, and macroeconomic data. Exogenous inputs include such things as: power plant capacity data, technology costs and performance data, transmission capacity, electric power import assumptions, and financial assumptions. The following sections describe the sources of these input data and a sample of the initial settings for the POEMS.

Demand/Macroeconomic

The sectoral demand forecasts are derived from NEMS demand models. The POEMS currently uses the AEO97 demands models. However, because demand is determined endogenously and electric sector price and fuel demand are different, end-use demand does not match that published by the EIA.

End-use load shapes are based on NERC load data. System load shapes are derived from FERC Form 714/715 filings for each PCA. Companies within each PCA have been defined by OnLocation largely based on FERC filings. The EIA AEO97 mid-case assumes 2.1% growth in GDP between 1995 to 2010.

AEO97 mid-case demand forecasts were as follows:

Sales (billion kWh)	1995	2000	2005	2010
Residential	1043	1137	1214	1307
Commercial	946	1024	1089	1147
Industrial	1013	1122	1218	1289
Transportation	6	7	24	41
Total	3008	3290	3545	3784

Supply

Fuel Prices

Fuel prices are supplied by the NEMS fuel supply modules. The POEMS currently uses the AEO97 fuel supply models. Again, because fuel prices and demand are determined endogenously, they will differ from that published by EIA.

AEO97 resource fuel prices were as follows:

Fuel prices (1995 dollars per unit)	1995	2000	2005	2010
World Oil Price (dollars per barrel)	17.26	18.20	19.72	20.41
Gas Wellhead Price (dollars per Mcf)	1.61	1.82	1.94	2.01
Coal Minemouth Price (dollars per ton)	18.83	18.38	17.47	16.92

Average delivered fuel prices to electric generators were as follows:

Delivered Prices (1995 Dollars per Million Btu)	1995	2000	2005	2010
Distillate Oil	3.94	4.52	4.77	4.92
Residual Oil	2.62	2.81	2.97	3.15
Natural Gas	2.01	2.19	2.28	2.32
Steam Coal	1.32	1.29	1.24	1.20

Generation Capacity assumptions

Production capacity assumptions regarding utility plants, exempt wholesale generators, and nontraditional cogenerators are derived from EIA and FERC filings (Form EIA-860, Form EIA-867, Form EIA-759, and Form EIA-767). The input assumptions include 1995 capacity and announced retirements and additions. Projected capacity will reflect these inputs, as well as endogenously determined additions and economic retirements.

Existing and Exogenously Planned Capacity (GW)	1995	2000	2005	2010
Winter	755	759	752	745
Summer	743	747	740	734

Firm purchase power contracts are derived from EIA Form 411 filings. These include existing wholesale contracts between utilities.

Firm Power Contracts (GW)	1995	2000	2005	2010
Winter	9.5	8.7	6.5	4.3
Summer	11.1	10.1	7.6	5.1

New cogeneration is added in a linear relationship to projected increases in industrial steam demand, and passed from the demand models. While the POEMS will produce a slightly different result when run with the demand modules, AEO97 mid-case assumptions regarding cogeneration are as follows:

	1995	2000	2005	2010
Total Cogeneration (GW)	45.1	47.6	50.2	52.3

Transmission Capacity assumptions

Transmission capacity is measured on a first contingency basis for each PCA from FERC 714 filings. Transmission capacity available for export from (and import into) each PCA is constrained to the PCA's maximum transmission path, and subject to line losses, transmission fees, and hurdle rates.

Because it does not make sense to sum up transmission capacity across PCAs, a national summary is not provided here.

Technology costs and performance assumptions

Technology cost and performance data for new plants is derived largely from EIA's AEO98 mid-case and NERC GADS data. The following table provides a brief summary of initial plant cost and performance settings. Capital costs are adjusted in the model using NEMS assumptions about uncertainty as reflected in technological optimism and learning factors. In addition, there are user options in POEMS which allow adjustments by technology and over time to O&M costs and heat rates of existing plants.

	Capital Costs (Nth of a Kind) ($1996/kW)	O&M Costs ($1996/kW)	Heat Rates (Nth of a kind) (Btu/kWh)	Availability
Pulverized Coal	1,079	15.9	9,087	.85
Advanced Coal	1,206	15.9	7,308	.85
Oil/Gas Steam	991	8.0	9,500	.85
Combined cycle - Conventional	440	5.3	7,000	.91
Combined cycle - Advanced	400	5.3	6,350	.91
Combustion Turbine - Conventional	325	2.7	10,600	.92
Combustion Turbine - Advanced	320	2.7	8,000	.92
Fuel Cell	1,440	5.3	5,361	.87
Nuclear	1,550	55.0	10,400	.85
Biomass	1,476	66.3	8,224	.80
Geothermal	2,025	95.7	N/A	.80
Municipal Solid Waste	5,289	0.0	16,000	.78
Solar Thermal	1,910	46.0	N/A	N/A
Solar Photovoltaic	3,185	9.7	N/A	N/A
Wind	965	25.6	N/A	N/A

Reserve margins

The need for reserve margins is related to the availability of each power control area's generation resources and the ability to trade with others. Over the last decade, plants have been getting more reliable in part due to the pressures of the wholesale competition. Both forced and scheduled outages have been reduced. Trading has also increased, especially after FERC Order 888 required transmission access. In addition there has been a growing use of interruptible load contracts, which have been factored into reserve margins. In order to reflect these continuing changes, POEMS uses a reserve margin of 8% for all regions of the country except Florida, which uses a 4% reserve margin.

Financial Assumptions

Cost of service pricing is based on 1995 FERC Form 1, EIA Form-412, and REA Forms 7 and 12 filings.

Discount rate/Costs of Capital: A number of different discount rates and costs-of-capital are at work in the model structure.

For the reference scenario ---

- Utility cost of capital and capital structure – applies to both the annual revenue requirement calculations (for all segments, that is to say, the generation, transmission and distribution functional segments) and to the expansion planning decision regarding the discount rate applied to calculate the present value of meeting the demand.
- EWG cost of capital and capital structure – applies to the annualized costs associated with each generation technology's investment requirement and the resultant annuity added to the fixed O&M costs in the "purchased" power portion of the revenue requirements associated with new builds. All new, unplanned builds are assumed to be Exempt Wholesale Generators (EWGs).

For the competitive scenario ---

- Utility cost of capital and capital structure – applies to the annual revenue requirement calculations for the transmission and distribution functional segments only.
- EWG cost of capital and capital structure – applied the same as in the reference case, except the assumed values are raised to reflect the greater risks assumed in the competitive environment; also used in the expansion planning decision.

Case		Utility	EWG
Reference	Debt Fraction	0.49 - .66**	0.65
Reference	Return on Debt	0.10	0.10
Reference	Return on Equity	0.10 - 0.14*	0.18
Competitive	Debt Fraction	0.49 - .66**	0.60
Competitive	Return on Debt	0.10	0.10
Competitive	Return on Equity	0.10 - 0.14*	0.20

* Utility Return on Equity is a function of the national yield on new AA bonds and some additional basis points, and varies by year.

** Utility Debt Fraction varies by region.

Transmission charges

Wheeling charges are set to some percentage (generally 50 to 80 percent) of the average FERC Order #888 stage one pro forma point-to-point tariff. A summary of wheeling fees by region is provided in Attachment A.

Policy Office Electricity Modeling System (POEMS) Model Documentation

Attachment A
Regional Model Inputs

Annual Peaks in 1995

	Region name	Peak (mw)
1	ECAR	83,375
2	ERCOT	43,132
3	MAAC	45,949
4	MAIN	42,175
5	MAPP	25,096
6	NEPX	19,284
7	NYPP	26,656
8	FL	28,335
9	SERC	100,574
10	SPP/N	13,295
11	SPP/SE	23,191
12	SPP/WC	17,338
13	WSCC/AZN	11,947
14	WSCC/CNV	44,496
15	WSCC/NWP	35,980
16	WSCC/RMPA	6,226

Winter Planned and Existing Capacity (Mw)

Region name	1995	2000	2005	2010
ECAR	109,938	111,221	111,221	110,441
ERCOT	55,178	56,279	56,507	58,104
MAAC	60,045	60,024	60,024	57,060
MAIN	52,905	52,921	49,755	47,150
MAPP	33,780	34,052	33,107	33,107
NEPX	27,080	25,632	24,315	23,793
NYPP	37,085	37,026	36,257	34,876
FL	37,794	38,319	38,319	38,319
SERC	125,478	126,658	125,593	125,593
SPP/N	17,564	17,570	17,570	17,570
SPP/SE	32,448	32,448	32,448	32,448
SPP/WC	24,366	24,366	24,366	24,366
WSCC/AZN	20,081	20,511	20,511	20,511
WSCC/CNV	56,717	56,787	56,807	56,807
WSCC/NWP	51,331	52,137	52,125	52,125
WSCC/RMPA	11,140	11,268	11,268	11,268
Total U.S.	754,927	759,222	752,201	745,551

Summer Planned and Existing Capacity (Mw)

Region name	1995	2000	2005	2010
ECAR	108,083	109,366	109,366	108,611
ERCOT	54,951	56,051	56,280	57,876
MAAC	57,632	57,629	57,629	54,715
MAIN	51,876	51,892	48,809	46,203
MAPP	32,814	33,087	32,158	32,158
NEPX	26,420	25,005	23,699	23,203
NYPP	35,880	35,834	35,091	33,710
FL	36,351	36,877	36,877	36,877
SERC	123,877	125,057	123,992	123,992
SPP/N	17,330	17,336	17,336	17,336
SPP/SE	32,442	32,442	32,442	32,442
SPP/WC	24,219	24,219	24,219	24,219
WSCC/AZN	19,897	20,327	20,327	20,327
WSCC/CNV	56,440	56,510	56,529	56,529
WSCC/NWP	51,431	52,234	52,224	52,224
WSCC/RMPA	11,037	11,165	11,165	11,165
Total U.S.	742,677	747,031	740,148	733,598

Winter Contracts (Mw)

region name	1995	2000	2005	2010
ECAR	807	-12	-90	-60
ERCOT		-9		0
MAAC	-409	-560		0
MAIN	427	154	110	73
MAPP	-508	-259	-266	-177
NEPX	-1,074	-1,040	-383	-255
NYPP	437	529	389	259
SERC	-910	42	205	137
SPP/N	-439	-121	-5	-3
SPP/SE	447	168	24	16
SPP/WC			-5	-3
WSCC/AZN	-3,450	-3,136	-2,352	-1,568
WSCC/CNV	-3,113	-2,830	-2,123	-1,415
WSCC/NWP	-3,287	-2,988	-2,241	-1,494
WSCC/RMPA	317	288	216	144
Total U.S.	-9,533	-8,666	-6,500	-4,333

Summer Contracts (Mw)

region name	1995	2000	2005	2010
ECAR	1,463	490	141	94
MAAC	-374	-154	0	0
MAIN	326	126	262	175
MAPP	-629	-1,162	-947	-631
NEPX	-643	-500	-380	-253
NYPP	-262	-622	-167	-111
SERC	-1,310	-322	-68	-45
SPP/N	-407	-95	21	14
SPP/SE	393	168	24	16
SPP/WC				-40
WSCC/AZN	-5,366	-4,878	-3,658	-2,439
WSCC/CNV	-5,331	-4,846	-3,635	-2,423
WSCC/NWP	-510	-464	-348	-232
WSCC/RMPA	73	66	50	33
Total U.S.	-11,134	-10,122	-7,592	-5,061

Wheeling Charges ($/MWh)	
Region	Dollars Per MWh (Discounted 50%)
ECAR	2.66
ERCOT	1.89
MAAC	2.39
MAIN	1.88
MAPP	3.11
NEPX	1.69
NYPP	3.81
FL	2.13
SERC	2.01
SPP/N	2.07
SPP/SE	2.76
SPP/WC	2.29
WSCC/AZN	4.27
WSCC/CNV	3.32
WSCC/NWP	4.25
WSCC/RMPA	2.54

Claimed Savings in Carbon Permit Fee Costs Based on CEA Assumptions About Energy Efficiency

Q31. What are the "claimed savings" in carbon permit fee costs based on the CEA assumptions about energy efficiency? Please give the range that corresponds to the range covered by Dr. Yellen in her testimony.

A31. In all illustrative analyses presented in Dr. Yellen's testimony and in the Administration's economic analysis, the assumed rate of autonomous energy efficiency improvement was 0.96% per year, the default value used by the team at Battelle Laboratory that designed the Second Generation Model. There are no "claimed savings" associated with this energy efficiency improvement, since this rate is assumed to be in both the baseline projection of emissions and policy scenarios. For a full discussion of energy efficiency improvement, refer to pp. 46-47 of the AEA. For a discussion of the effects of the tradable permit system on energy efficiency, refer to p. 53 of the AEA. *(Pages 46-47 and 53 of the AEA follows.)*

Energy Efficiency Improvement

Energy efficiency improvements over time -- defined as the rate at which the total use of energy falls relative to GDP -- are attributable to three factors: changes in energy conservation due to price changes; the effects of non-price policy measures to improve energy efficiency (such as government support of R&D); and *autonomous* increases in energy efficiency. The first factor reflects the incentive provided by higher energy prices for firms and households to reduce energy consumption through efficiency measures and thereby make the economy as a whole more energy efficient. The second factor reflects the potential influence of a wide range of non-price public policies to improve the efficiency with which energy is used in the economy. For example, measures could be undertaken to speed the rate of diffusion and adoption of technologies which can simultaneously lower energy use and household and business energy bills. Finally, energy efficiency improvements occur over time which are independent of both prices and energy policies. For example, in the United States, the gradual transition from a manufacturing economy to a less energy-intensive service economy has improved the energy efficiency of the economy. The *autonomous energy efficiency improvement factor (AEEI)*[15] reflects only the pace of

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[15] The Autonomous Energy Efficiency Improvement should be distinguished from the annual energy efficiency improvement used by some in the literature. The annual rate includes the autonomous component as well as price-induced and non-price

(continued...)

efficiency improvements that are purely autonomous and thus independent of both energy prices and energy policies.

In modeling energy efficiency improvement, these three components are addressed in different ways. For the *autonomous* energy efficiency factor (AEEI), a plausible assumption is an improvement of about 1.0 percent per year. The developers of the Second Generation Model employ an AEEI of 0.96 percent per year as their default energy efficiency assumption. Similarly, the Energy Information Administration analysis (see Energy Information Administration 1997a) assumes a pace of energy efficiency improvement of 0.9 percent. In this analysis, we used the SGM default assumption concerning the autonomous energy efficiency parameter. For price-induced changes in energy efficiency, the model generates its own forecasts of changes in energy consumption that reflect the effects of greenhouse gas permit prices on energy prices.

Economists have traditionally had difficulty in modeling non-price policy-induced shifts in energy efficiency. For example, it is hard to assess the likely future pay-off from investments in energy R&D, although historical estimates of the rate of return to society from such investments are substantial. Similarly, the series of policy measures proposed by the Administration -- such as the Administration's electricity restructuring proposal, the Climate Change Technology Initiative, its voluntary sectoral initiatives, the federal sector's own energy efficiency program or other measures that could be adopted to spur the diffusion and adoption of existing technologies -- could substantially reduce the cost of mitigation and increase the amount of reductions achieved domestically. However, models like the Second Generation Model do not have the capacity to quantify these potential payoffs.

Some authorities in the field of energy policy, using an engineering approach rather than an economic paradigm, have sought to quantify the extent to which policy initiatives could spur more rapid improvements in energy efficiency. Experts at five national laboratories managed by the Department of Energy found that a third of the emissions reductions necessary to return to 1990 levels by 2010 could be achieved through the adoption of existing energy-efficiency technologies at no net resource cost. This translates into a non-price policy related efficiency contribution of 0.3% per year (Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies 1997). The National Academy of Sciences reached qualitatively similar conclusions in a 1992 report. As reflected in the Department of Energy study, if a higher rate of energy efficiency improvement were achieved, the United States could meet a correspondingly larger fraction of its commitment through domestic reductions potentially at lower permit prices.

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[15] (...continued)
policy-induced components.

The Administration supports effective international trading and meaningful participation by key developing countries. An assessment using the SGM model that accounts for effective trading and developing country participation yields permit price estimates ranging between $14/ton and $23/ton, and resource costs between $7 billion and $12 billion/year (see Table 5). The range reflects uncertainty about the extent of Annex I participation in international trading.

Table 5. U.S. Permit Prices and Resource Costs Under the Administration's Policies

Trading Scenario	**Permit Price**	**Total Resource Cost**	**Share of 2010 GDP**
Umbrella with Eastern Europe + key developing country participation	$14/ton	$7 billion/year	0.07%
Annex I + key developing country participation	$23/ton	$12 billion/year	0.11%

The illustrative modeling analysis does not account for several key components of the Kyoto Protocol and the Administration's policies to reduce greenhouse gas emissions. These key issues include the benefits of reducing net emissions through carbon sinks, the Administration's electricity restructuring proposal, the Administration's Climate Change Technology Initiative, the Administration's sectoral consultations to encourage and support voluntary efforts by U.S. industry to undertake emissions reductions, including the provision of credit for early action, and the Administration's efforts to reduce federal energy use. Each of these factors has the potential to significantly increase the amount of reductions made domestically, while lowering the level of permit prices. The model estimates do incorporate the effects of higher energy prices on energy efficiency: results reflect annual rates of energy efficiency improvement of 1.10 - 1.21%, where 0.96% per year is the autonomous energy efficiency improvement and 0.14 - 0.25% is the price-induced energy efficiency improvement. However, any additional payoffs from the CCTI or electricity restructuring are not included in this range. The illustrative model also does not account for ancillary benefits of reducing greenhouse gas emissions, such as improved local air quality, nor does it account for the benefits of averting the risks of climate change (see pp. 66, 69). For a discussion of these cost mitigating factors, see page 62.

Q31.1 What is the basis for the CEA assumed energy efficiency?

A 31.1 For a full discussion of energy efficiency improvement, refer to pp. 46-47 of the AEA. *(See pages 46-47 of the AEA above.)*

Q31.2 How does the CEA assumed energy efficiency differ from the current Department of Energy (DOE) Energy Information Administration forecast? If there is a difference between the assumption and the forecast, please document the rationale for the change, including assumptions about price signals required to reach the level.

A31.2 The Administration's economic analysis employed the default SGM AEEI of 0.96% per year. In creating the U.S. module in SGM, Battelle Laboratory used the EIA Annual Energy Outlook (AEO). For the version of the model used by the Administration, this included the 1997 AEO, which has a rate of energy efficiency improvement of 0.92% per year over the 1995-2015 period. The difference of 0.04% per year is simply a product of model construction, and has a very negligible impact on projected emissions. For a full discussion of the energy efficiency issue, please refer to pp. 46-47 of the AEA. *(See pages 46-47 of the AEA above.)*

Claimed Savings in Carbon Permit Fee Costs Based on CEA Assumptions About Trading Among Annex I Countries

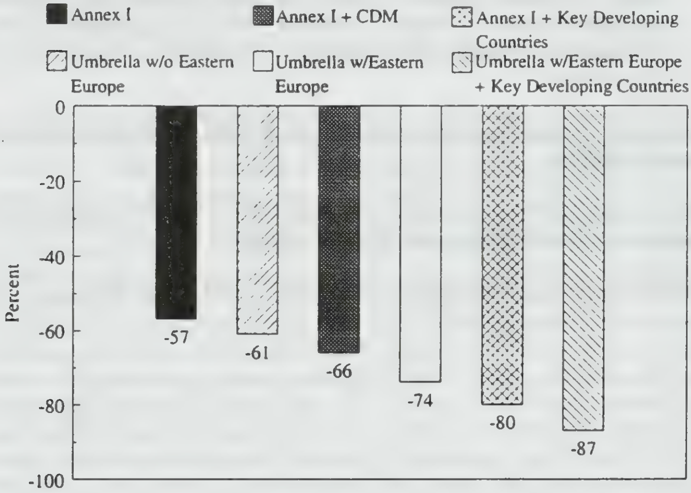
Q32. What are the "claimed savings" in carbon permit fee costs based on the CEA assumptions about trading among Annex I countries?

A32. Please refer to pp. 51-53 of the AEA. *(Pages 51-53 of the AEA follow.)*

Economic Cost of the Administration's Policies to Reduce Greenhouse Gas Emissions in the Illustrative Analysis

The flexibility measures embodied in the Kyoto Protocol and the Administration's climate change approach could dramatically reduce the costs of complying with the Protocol (see Figure 19 and Table 4.) An effective international market for trading emissions permits among industrialized countries -- even without taking into account the added benefit of including key developing countries -- would potentially lower the resource cost to the United States of climate change policy by more than half relative to a scenario in which all abatement is performed domestically and would lower the price for emission permits (expressed as carbon equivalent) by nearly three

Figure 19. Percentage Reductions in Resource Costs Relative to "Domestic Only" Abatement Under Various Trading Scenarios



fourths.[16] If international trading took place only among "umbrella countries" (Annex I except for, in one scenario, the European Union, and, in another scenario, the European Union and Eastern Europe) resource costs could drop by 60-75% as compared to the domestic only cost, while permit prices could drop by 75-85% compared to a "domestic only" approach. Trading among industrialized countries alone could bring costs down into a relatively modest range.

An effective Clean Development Mechanism combined with industrialized country trading could reduce resource costs by two-thirds to four-fifths and could lower permit prices 79 - 88% compared to a domestic only approach. Finally, if some developing countries adopt growth emissions targets and participate in an effective trading system, the total resource cost to the United States could fall by 80 - 87% compared to a domestic only approach, while permit prices could sink by 88 - 93% compared to a domestic only effort.

Table 4. Permit Prices and Resource Costs Relative to "Domestic Only" Abatement of Various Trading Scenarios

Trading Scenario	Percent Reduction in Permit Price (relative to domestic only)	Percent Reduction in Resource Cost (relative to domestic only)
Annex I	72%	57%
Umbrella (with Eastern Europe)	85%	74%
Umbrella (without Eastern Europe)	75%	61%
Annex I + Key Developing Countries	88%	80%
Umbrella (with Eastern Europe) + Key Developing Countries	93%	87%
Umbrella (without Eastern Europe) + Key Developing Countries	91%	83%
Annex I + CDM	79%	66%
Umbrella (with Eastern Europe) + CDM	88%	80%
Umbrella (without Eastern Europe) + CDM	82%	71%

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[16] "Resource cost" refers to the direct cost to the U.S. economy of meeting its Kyoto target measured as the cost of emissions abated domestically plus the cost of purchases of international emissions allowances and emissions credits by U.S. firms. "Permit price" refers to the price paid for a permit to emit one metric ton of carbon equivalent. The permit price can be translated readily into an added increment for U.S. energy prices. See, for example, Table 6.

The Administration supports effective international trading and meaningful participation by key developing countries. An assessment using the SGM model that accounts for effective trading and developing country participation yields permit price estimates ranging between $14/ton and $23/ton, and resource costs between $7 billion and $12 billion/year (see Table 5). The range reflects uncertainty about the extent of Annex I participation in international trading.

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Trading Scenario	**Permit Price**	**Total Resource Cost**	**Share of 2010 GDP**
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The illustrative modeling analysis does not account for several key components of the Kyoto Protocol and the Administration's policies to reduce greenhouse gas emissions. These key issues include the benefits of reducing net emissions through carbon sinks, the Administration's electricity restructuring proposal, the Administration's Climate Change Technology Initiative, the Administration's sectoral consultations to encourage and support voluntary efforts by U.S. industry to undertake emissions reductions, including the provision of credit for early action, and the Administration's efforts to reduce federal energy use. Each of these factors has the potential to significantly increase the amount of reductions made domestically, while lowering the level of permit prices. The model estimates do incorporate the effects of higher energy prices on energy efficiency: results reflect annual rates of energy efficiency improvement of 1.10 - 1.21%, where 0.96% per year is the autonomous energy efficiency improvement and 0.14 - 0.25% is the price-induced energy efficiency improvement. However, any additional payoffs from the CCTI or electricity restructuring are not included in this range. The illustrative model also does not account for ancillary benefits of reducing greenhouse gas emissions, such as improved local air quality, nor does it account for the benefits of averting the risks of climate change (see pp. 66, 69). For a discussion of these cost mitigating factors, see page 62.

Q32.1 Please provide the Administration projection of carbon emission reduction requirements for all Annex I countries for the years 2000-2020 by year.

A32.1 The Administration does not have an estimate of carbon emissions reductions required to meet the targets in Annex B of the Kyoto Protocol. Since Article 3 of the Protocol allows for countries to reduce emissions of six types of greenhouse gases in aggregate, it is not possible to develop an estimate of necessary reductions for just one type of gas.

Q32.2 What contingencies have been assumed about changes in economic forecasts beginning in 2008 that could affect the availability of emissions credits?

A32.2 Long-term economic forecasts usually employ long-term growth rates, and do not attempt to include business cycle fluctuations. As such, there have been no assumptions about either recessions or growth spurts starting in 2008 in the Administration's analysis.

Q32.3 What is the assumed price for the emissions permit fees for each year beginning in 2000 through 2020?

A32.3 The Administration has developed permit price estimates in an illustrative analysis that reflects the average permit price over the 2008-2012 commitment period. This is consistent both with the Administration's position to have a domestic cap and trade program in place for the first commitment period and with Article 17 of the Kyoto Protocol that provides the right for international trading in emissions allowances. Since emissions targets have not been established for the second or subsequent commitment periods, it is not possible to estimate emission prices without making arbitrary assumptions about countries' post-2012 emissions paths. For a review of the Administration's illustrative analysis of permit prices, please refer to pp. 51-53 of the AEA. (See above reference text.)

Q32.4 What is the impact of possible limits to available emissions credits if the limit is set at 50%? What is the impact if the limit is set at 25%?

A32.4 The Administration is opposed to limits on trading because they are not authorized by the Protocol and would raise the cost of achieving the environmental goal established in the Kyoto Protocol. The question is unclear as to whether the "limit set at 50%" corresponds to 50% of total emissions, 50% of emissions allowed under a country's emissions target, 50% of required reductions by net buyers, or 50% of all reductions undertaken by net sellers. The Administration has not conducted analyses on all of these permutations.

Q32.5 Are European Union countries allowed to buy credits from countries outside the "bubble" for the first budget period (2008-2012)? Are they allowed to buy credits outside the bubble for subsequent budget periods?

A32.5. These questions are not yet resolved, and will be addressed as we move forward to develop rules for the trading system. The Kyoto Protocol does not prohibit EU countries from trading outside the EU Bubble. However, in considering rules for emissions trading, we will need to consider whether countries operating under Article 4 should also be allowed to trade with Parties outside that article.

Claimed Savings in Carbon Permit Fee Costs Based on CEA Assumptions About Trading with Non-Annex I Countries through the Clean Development Mechanism

Q33. What are the "claimed savings" in carbon permit fee costs based on the CEA assumptions about trading with non-Annex I countries through the Clean Development Mechanism (CDM)?

A33. For an overview of the potential cost-savings associated with the CDM, please refer to pp. 51-52 of the AEA. *(Pages 51-52 of the AEA follow.)*

Economic Cost of the Administration's Policies to Reduce Greenhouse Gas Emissions in the Illustrative Analysis

The flexibility measures embodied in the Kyoto Protocol and the Administration's climate change approach could dramatically reduce the costs of complying with the Protocol (see Figure 19 and Table 4.) An effective international market for trading emissions permits among industrialized countries -- even without taking into account the added benefit of including key developing countries -- would potentially lower the resource cost to the United States of climate change policy by more than half relative to a scenario in which all abatement is performed domestically and would lower the price for emission permits (expressed as carbon equivalent) by nearly three

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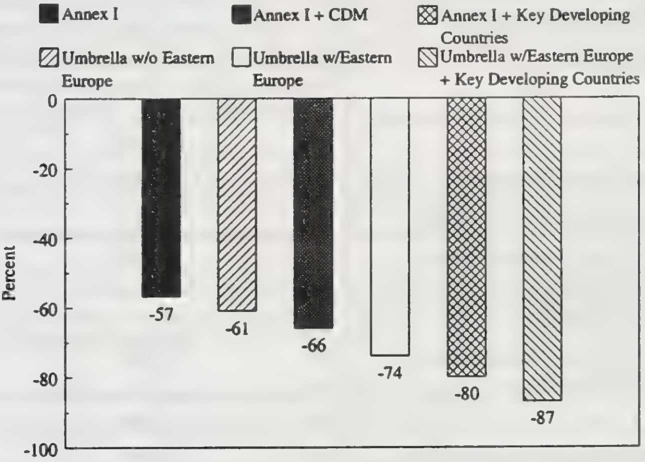

fourths.[16] If international trading took place only among "umbrella countries" (Annex I except for, in one scenario, the European Union, and, in another scenario, the European Union and Eastern Europe) resource costs could drop by 60-75% as compared to the domestic only cost, while permit prices could drop by 75-85% compared to a "domestic only" approach. Trading among industrialized countries alone could bring costs down into a relatively modest range.

An effective Clean Development Mechanism combined with industrialized country trading could reduce resource costs by two-thirds to four-fifths and could lower permit prices 79 - 88% compared to a domestic only approach. Finally, if some developing countries adopt growth emissions targets and participate in an effective trading system, the total resource cost to the United States could fall by 80 - 87% compared to a domestic only approach, while permit prices could sink by 88 - 93% compared to a domestic only effort.

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[16] "Resource cost" refers to the direct cost to the U.S. economy of meeting its Kyoto target measured as the cost of emissions abated domestically plus the cost of purchases of international emissions allowances and emissions credits by U.S. firms. "Permit price" refers to the price paid for a permit to emit one metric ton of carbon equivalent. The permit price can be translated readily into an added increment for U.S. energy prices. See, for example, Table 6.

Q33.1 What is the assumed cost in $/metric ton carbon for the secretariat fee for the CDM?

A33.1 In the Administration's illustrative analysis, a secretariat fee was not assumed in analyzing the CDM. However, the Administration did assume that, because of higher transaction costs (e.g., less comprehensive than trading due to its project-specific nature, a secretariat fee, etc.), the CDM would not generate equivalent emissions reductions at a given price to a system with trading by developing countries with emissions targets. For a review of the assumptions in the illustrative analysis on CDM, please refer to p. 48 of the AEA. *(Page 48 of the AEA follows.)*

Trading Scenarios

Intergas Trading

We assumed that trading occurs across all gases based on 100-year global warming potential values.

Trading Blocs

The Administration assessed three different industrialized country trading blocs.

- Annex I implies trading among all Annex I countries.
- Umbrella without Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union and Eastern European countries.
- Umbrella with Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union.

In addition, we assessed two forms of developing country participation in conjunction with the industrial country trading blocs.

- Developing countries generate emissions credits through the Clean Development Mechanism and sell them internationally. The CDM is assumed to provide 20% of emissions reductions that a country would otherwise undertake if it agreed to a target at business as usual and participated in international trading.
- Key developing countries are assumed to adopt emissions growth targets equal to their 2010 business as usual emissions level and participate in international emissions trading.

Q33.2 What is the range of possible charges for payments to non-Annex I countries for impact on their economies?

A33.2 No specific charges for payments to non-Annex I countries have been assumed in the AEA. A proposal for "compensation (albeit one which does not propose specific amounts) has been made by a number of OPEC countries; the United States and our allies have strongly rejected it. We will continue to reject payments to non-Annex I countries for actions we take to mitigate climate change.

Q33.3 What is the range of possible fees to be paid to non-Annex I countries through the CDM?

A33.3 As part of any clean development mechanism transaction, a project developer would be free to work out contractual details of payments to the host government or cooperative partner in the host country; such arrangements would not be dictated by the international system. Payment could be taken in any of a number of ways, e.g., as a reduced price for project development, as tons of carbon equivalents, or in hard currency. It should be noted that the Protocol calls for a share of the proceeds to be used to assist vulnerable developing countries to adapt to climate change itself; we anticipate this being a very small percentage of the total CDM project cost.

Q33.4 What contingencies are there for changed economic circumstances in non-Annex I countries that could restrict access to emissions credits beginning in 2000?

A33.4 The model used to assess opportunities through trading and the Clean Development Mechanism assumes long-term economic growth for developing countries and is not set up to model "changed economic circumstances" such as business cycle fluctuations. While it is not clear how changed economic circumstances would actually restrict access to credits, no contingencies have been developed or assessed.

Administration Assumptions About Future Emissions Reductions Beyond 2012

Q34. It is my understanding that Dr. Yellen has testified that knowing the range of future reductions is important to any analysis since it will influence trading.

Q34.1 What assumptions have been made by the Administration about further reductions beyond 2012 as suggested by the President in his October 1997 policy announcement?

A34.1 No assumption about emissions targets for the second or subsequent commitment periods has been made because the Administration does not yet have a position on targets beyond 2012.

Q34.2 Have these further reductions been factored into the CEA evaluation, and if not, why not?

A34.2 Since there is no Administration position on subsequent emissions targets, the Administration analysis does not include any arbitrary assumptions about targets in the second or later commitment periods.

Use of Treasury Department Economic Model in Kyoto Negotiations

Q35. I understand that when you testified before the Senate Foreign Relations Committee on February 11 you stated that the Administration "didn't even sneeze" in Kyoto without consulting an economic model prepared by the Treasury Department.

Q35.1 Is my understanding as stated above correct, and if not, what is the correct information?

A35.1 During the Kyoto negotiations, staff from the Treasury Department and the Council of Economic Advisers used model outputs from the Second Generation Model to analyze economic implications for the United States of different negotiating positions that arose, as well as the economic implications of the flexibility mechanisms we sought to achieve at Kyoto.

Q35.2 What was this model?

A35.2 The Second Generation Model.

Q35.3 What specifically were/are the results of this model with regard to the commitments you made in Kyoto?

A35.3 For the results from the Second Generation Model, please see the illustrative modeling analysis in "The Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis, July 1998" (see pp. 39-72). *(Pages 39-72 of the AEA follow.)*

ASSESSING THE COSTS AND BENEFITS OF REDUCING GREENHOUSE GAS EMISSIONS

Preliminary Assessment

The Administration employed a variety of tools to assess the various possible costs and non-climate benefits of our emissions reduction policy. Our overall conclusion is that the net costs of the Administration's policies to reduce emissions are likely to be relatively modest, assuming those reductions are undertaken in an efficient manner with effective international trading, the Clean Development Mechanism, meaningful developing country participation, and sound domestic policies. That potential small net premium, even excluding the benefits of mitigating climate change, purchases a partial insurance policy against a serious environmental threat. Further, although we think the economic benefits of mitigating climate change are subject to too many uncertainties to quantify, those benefits over time are likely to be real and large (see p. 69).

In reaching this conclusion, the Administration has drawn on the insights of a wide range of models of the energy sector and economy over the next 25 years, including but not limited to the results of the Stanford Energy Modeling Forum (Gaskins and Weyant 1993, Weyant 1997), the Intergovernmental Panel of Climate Change's review of the economic and social dimensions of climate change (Bruce et al. 1996), the work of the OECD on the economic dimensions and policy responses to global warming (OECD 1998), and the Administration's staff-level interagency analysis (Interagency Analytical Team 1997). In addition, the Administration used other tools, such as a meta-analysis (Repetto and Austin 1997), overviews of the domestic and international energy sectors (Energy Information Administration 1997a, d), simple statistics regarding energy efficiency, greenhouse gas emissions, and economic indicators from World Bank, International Energy Agency, and Energy Information Administration databases, and basic economic reasoning.

The conclusion that the impact of the Administration's policies to address the risks of climate change will be modest is not entirely dependent upon, but is fully consistent with, formal model results. The Administration continues to believe that there are limitations to relying on any single model to assess the economic impact of the Kyoto Protocol. However, model results can further inform and improve the understanding of the effects of climate change policy. To complement the economic analysis of the Administration's policy to address climate change, we have conducted

an illustrative assessment with a modified version of the Second Generation Model. The results from the SGM substantiate the conclusion that the economic effects of an efficient, effective, and global policy to address the risks of climate change will be modest.

Difficulties of an Economic Analysis of Climate Change

The difficulties associated with economic analysis of climate change fall into three broad categories. First are the uncertainties that still remain over the operational considerations of the treaty, necessitating assumptions on which the analysis is predicated. Second are the inherent limitations of available models to analyze the costs of abating emissions. Third, it is extremely difficult to quantify the long-term economic benefits of climate change mitigation, although such benefits are the motivation for the Kyoto Protocol. Economists have a difficult time projecting the behavior of the economy over the next quarter or year, let alone over the next two decades. The scale of the forecasting exercise is therefore daunting, and any specific results should be treated with substantial caution.

Uncertainties in the International Effort to Combat Climate Change

The Kyoto Protocol provides the foundation for the international effort to address climate change. However, the Protocol is still a work-in-progress. Uncertainties about the ultimate characteristics of the international climate change policy regime provide challenges in conducting an economic assessment.

For example, some of the rules pertaining to the flexibility mechanisms in the Kyoto Protocol, such as emissions trading and carbon sinks, require further delineation. These issues and others, including the role of developing countries, will be addressed in future negotiations.

More importantly, the international community has not yet negotiated agreements to limit greenhouse gas emissions beyond the 2008 to 2012 window. The emissions targets established in Kyoto provide for the first of many necessary steps to address the risks of climate change. The first step is critical because it sends a signal to the private sector regarding the value of reducing greenhouse gas emissions and it begins the task of reducing emissions relative to the business as usual path. However, subsequent steps are also necessary to address climate change risks adequately. Lack of knowledge regarding what the subsequent steps will be complicates any analysis of climate change mitigation.

Inherent Limitations of Models

In addition to these uncertainties about the details of the international effort to address climate change, there are the inherent limitations of the models used to evaluate that effort. Even within a given model, answers depend critically on the precise nature of the question asked. For example, the costs of emissions reductions depend on the extent of global participation and international trading that a treaty is assumed to feature. But in addition to the dependence of the results from a given model on the precise assumptions, different models can give different answers even when all the assumptions are specified to be the same -- a concrete illustration of the range of uncertainty surrounding the predictions of any one individual model.

Benefits of Averting Climate Change

As discussed in the risks of climate change section, it is evident that the benefits of averting climate change are potentially very large. There are several difficulties associated with monetizing the benefits of averting the risks of climate change. First, there is the uncertainty relating to the specific effects of climate change (e.g., would the planet be 2 or 6 ° F warmer in 2100, or some level within that range, without any measures to abate emissions). Second, the uncertainty over the extent that benefits should be discounted because they occur in the distant future presents challenges. Since the benefits of stemming future climate change accrue over not only decades but centuries, small changes in the discount rate can produce substantial changes in the results. Third, the benefits depend on global emissions paths after the 2008 to 2012 budget period specified in Kyoto. To calculate the benefits of averting climate change-induced damages, it is necessary to know the emissions path for many years beyond 2012. Thus while the benefits of getting started on the Kyoto path to reducing greenhouse gas emissions may be large over time, we cannot estimate these benefits without knowing where the path goes in the years after the Kyoto compliance period.

Illustrative Calculations: Methodology

Recognizing the difficulties inherent in an economic analysis, the Administration nonetheless undertook an examination of the economic impact on the U.S. economy of the Kyoto Protocol. Since no one model exists to handle all of the parameters of the Kyoto agreement, several tools had to be used to calculate the estimated costs of climate policy. First, the Administration constructed emissions baselines for all six types of greenhouse gases and 2010 business as usual levels for these gases for Annex I countries. These emissions estimates would serve as the basis for calculating the emissions reductions required to achieve the Kyoto targets. Second, we developed cost curves for reducing greenhouse gas emissions. For carbon dioxide, marginal abatement cost curves were derived from more than 60 model runs with the Second Generation Model. For other greenhouse gases, we used a bottom-up marginal abatement cost curve developed by the Interagency Analytical Team (1997). Third, we assessed several different trading scenarios based on the required emissions reductions and the constructed cost curves. Equalizing marginal costs across countries and regions generated a common permit price across the trading bloc. Fourth, we calculated the effects of the permit price on energy prices, energy consumption, GDP, investment, and consumption.

Construction of a 6 Gas Baseline and 2010 "Business as Usual" Baseline

To assess the potential economic impact of the Kyoto Protocol, it was first necessary to construct 1990/1995 baseline emissions and business as usual emissions paths that account for all six categories of greenhouse gases. While estimates of 1990 emissions and 2010 projected emissions for carbon dioxide are widely available for most Annex I countries and many large Non-Annex I countries, the Administration gathered data on the other greenhouse gases from more than 25 submitted National Communications to the Framework Convention on Climate Change, official reports of the Framework Convention, and Environmental Protection Agency and Department of Energy analyses. In some cases, we made extrapolations from one country to another based on common characteristics (e.g., GDP). These data provide the basis for our preliminary estimates until the parties to the Framework Convention provide more detailed information on historical and projected emissions of all six categories of greenhouse gases. With these baseline estimates, the Administration estimated the magnitude of the emissions reductions required of Annex I countries under the Protocol.

Carbon Dioxide Emissions

For projections of carbon dioxide, we used the business as usual projections in the Second Generation Model, with the exception of the United States, where we used the more recent Energy Information Administration (1997a) estimate of 2010 BAU for energy-based CO_2 and the Climate Action Report (1997) projection for non-energy-based CO_2. For the European Union, the Administration adjusted the Western Europe value in SGM to reflect the non-participation of Iceland, Norway, Switzerland, and Turkey in the E.U. bubble. Based on CO_2 emissions estimates from the Carbon Dioxide Information Analysis Center, we deducted 66.1 MMTCE from the Western Europe estimate to derive the E.U. 1990 baseline CO_2 emissions value. For 2010 BAU, 85 MMTCE were deducted from the Western Europe 2010 estimate.[12]

Emissions of Other Greenhouse Gases

For projections of the other five categories of greenhouse gases, we used information provided in the national communications to the Framework Convention on Climate Change. In some cases, 2010 emissions were extrapolated from projections of 2000 emissions levels. In addition, some projections in emissions were based on growth rates in comparable countries. For a country-by-country discussion of the emissions baselines derivations, refer to Appendix B.

Converting to Carbon Equivalence

In all cases where data are provided in tons of gas, or tons of carbon dioxide equivalent, the Administration converted the data to tons of carbon equivalent based on their 100-year time horizon global warming potential (Houghton et al. 1996; refer to Table 2). Some countries aggregated all HFCs into one value (and in some cases, all PFCs into one value). We constructed an HFC weight and a PFC weight based on specific HFC and PFC emissions in the United States in 1995. For HFCs, the following weight was used:

$$[2*\mathrm{GWP}(\mathrm{HFC\text{-}134a}) + \mathrm{GWP}(\mathrm{HFC\text{-}23})]/3 = 1300$$

HFC-134a was 52% and HFC-23 was 21% of all U.S. HFC emissions in 1995 (Climate Action Report 1997). For PFCs, the following weight was used:

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[12] We assumed that these four non-E.U. European countries would experience the same emissions growth rate as the E.U. over the 1990-2010 period to calculate their 2010 emissions.

$$[2*GWP(CF_4) + GWP(C_6F_{14})]/3 = 1855$$

CF_4 was about 60% and PFC/PFPEs[13] were about 25% of all U.S. PFC emissions in 1995 (Climate Action Report 1997).

Carbon Sinks

The Kyoto Protocol specifies that removals of CO_2 by certain kinds of sinks count toward meeting emissions targets. Mechanisms are also provided for adding new categories of sinks. Very preliminary estimates suggest that incorporating the gains from carbon sinks throughout the world could substantially reduce the costs of meeting the Kyoto target, on top of the gains from trading among Annex I countries. Such gains could be substantial under business as usual and even larger after taking into account the additional effects of government policy. Government policy could, for example, provide an incentive to increase the activities qualifying as allowable sinks, like tree-planting. However, no model has yet tried to account for such additional effects. Because the quantitative uncertainty is so large, we do not yet have an estimate with which we are comfortable. But we expect that complete modeling of the Kyoto provision pertaining to sinks would have favorable effects on projected costs. For the analysis reported here, the Administration employed a conservative assumption that all countries' sinks equaled zero and that no country would implement policies to stimulate the creation of carbon sinks.

Kyoto Targets

The emissions targets for Annex I countries were from Annex B of the Kyoto Protocol. For Non-Annex I countries, the assumed emissions targets were equal to those countries' business as usual emissions levels in 2010.

Constructing Marginal Abatement Cost Functions

To construct marginal abatement cost functions for carbon dioxide, the Administration used model results from Battelle Laboratory's Second Generation Model (SGM). SGM is a computable general equilibrium model designed to provide

estimates of the economic costs of actions to reduce carbon dioxide emissions.[14] SGM models the energy sector in greater detail than other sectors, so it can provide information on the trade-offs in the consumption of different fuels under a policy to reduce carbon dioxide emissions. It also serves the purpose of evaluating the effects of international emissions trading, because it includes twelve countries and regions (see Table 3). The capacity of the SGM model to take into account international trading is an obvious virtue of this model relative to the other two models used in the Interagency Analytical Team process, both of which only modeled the economic effects of emissions reductions in the United States. The SGM, like all models used to assess economic effects, has strengths and weaknesses. Therefore, the results from this analysis should be considered illustrative. However, the results of the Stanford EMF's investigation of the implications of international trading suggest that the conclusion that effective international trading can significantly reduce costs is robust (Weyant 1997).

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[13] The Climate Action Report (1997) notes that "PFC/PFPEs are a proxy for many diverse PFCs and perfluoropolyethers (PFPEs), which are beginning to be used in solvent applications. Global warming potential and lifetime values are based upon C_6F_{14}" (p. 71).

Table 3. Countries/Regions in Second Generation Model

Annex I	**Non-Annex I**
United States	China
Western Europe	India
Former Soviet Union	Korea
Eastern Europe	Mexico
Japan	Rest of the World
Canada	
Australia	

Source: Second Generation Model

Abatement Cost Functions in Industrialized Countries

Drawing on results of more than 60 model runs from the SGM, the Administration developed country- and region-specific cost functions for carbon dioxide abatement by matching prices and emissions reductions in different model runs. For a given country or region, at a given emissions allowance price, the country/region reduces carbon emissions by a specified amount. Over a wide range of prices, the

relationship between the allowance price and emissions reductions can be traced out. This relationship depicts the approximate marginal abatement cost for the country or region. For the United States, we aggregated the cost functions for the non-carbon dioxide greenhouse gas emissions developed by the Interagency Analytical Team (1997) with the U.S. carbon dioxide cost function to generate a cost function for the entire basket of greenhouse gases. For all other countries and regions, we assumed the carbon dioxide cost function to hold for all six categories of greenhouse gases. Based on the pattern of U.S. abatement costs, this assumption for other countries would likely over-estimate the costs of abatement.

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[14] For more information about the Second Generation Model, refer to Edmonds et al. 1992.

Abatement Cost Functions in Developing Countries

The marginal abatement cost functions for developing countries only include opportunities to reduce carbon dioxide released through energy consumption. Given that numerous options for abatement of other greenhouse gases and sequestration projects in these countries exist, these functions in fact over-estimate the costs of developing country participation.

Energy Efficiency Improvement

Energy efficiency improvements over time -- defined as the rate at which the total use of energy falls relative to GDP -- are attributable to three factors: changes in energy conservation due to price changes; the effects of non-price policy measures to improve energy efficiency (such as government support of R&D); and *autonomous* increases in energy efficiency. The first factor reflects the incentive provided by higher energy prices for firms and households to reduce energy consumption through efficiency measures and thereby make the economy as a whole more energy efficient. The second factor reflects the potential influence of a wide range of non-price public policies to improve the efficiency with which energy is used in the economy. For example, measures could be undertaken to speed the rate of diffusion and adoption of technologies which can simultaneously lower energy use and household and business energy bills. Finally, energy efficiency improvements occur over time which are independent of both prices and energy policies. For example, in the United States, the gradual transition from a manufacturing economy to a less energy-intensive service economy has improved the energy efficiency of the economy. The *autonomous energy efficiency improvement factor (AEEI)*[15] reflects only the pace of

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[15] The Autonomous Energy Efficiency Improvement should be distinguished from the annual energy efficiency improvement used by some in the literature. The annual rate includes the autonomous component as well as price-induced and non-price

(continued...)

efficiency improvements that are purely autonomous and thus independent of both energy prices and energy policies.

In modeling energy efficiency improvement, these three components are addressed in different ways. For the *autonomous* energy efficiency factor (AEEI), a plausible assumption is an improvement of about 1.0 percent per year. The developers of the Second Generation Model employ an AEEI of 0.96 percent per year as their default energy efficiency assumption. Similarly, the Energy Information Administration analysis (see Energy Information Administration 1997a) assumes a pace of energy efficiency improvement of 0.9 percent. In this analysis, we used the SGM default assumption concerning the autonomous energy efficiency parameter. For price-induced changes in energy efficiency, the model generates its own forecasts of changes in energy consumption that reflect the effects of greenhouse gas permit prices on energy prices.

Economists have traditionally had difficulty in modeling non-price policy-induced shifts in energy efficiency. For example, it is hard to assess the likely future pay-off from investments in energy R&D, although historical estimates of the rate of return to society from such investments are substantial. Similarly, the series of policy measures proposed by the Administration -- such as the Administration's electricity restructuring proposal, the Climate Change Technology Initiative, its voluntary sectoral initiatives, the federal sector's own energy efficiency program or other measures that could be adopted to spur the diffusion and adoption of existing technologies -- could substantially reduce the cost of mitigation and increase the amount of reductions achieved domestically. However, models like the Second Generation Model do not have the capacity to quantify these potential payoffs.

Some authorities in the field of energy policy, using an engineering approach rather than an economic paradigm, have sought to quantify the extent to which policy initiatives could spur more rapid improvements in energy efficiency. Experts at five national laboratories managed by the Department of Energy found that a third of the emissions reductions necessary to return to 1990 levels by 2010 could be achieved through the adoption of existing energy-efficiency technologies at no net resource cost. This translates into a non-price policy related efficiency contribution of 0.3% per year (Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies 1997). The National Academy of Sciences reached qualitatively similar conclusions in a 1992 report. As reflected in the Department of Energy study, if a higher rate of energy efficiency improvement were achieved, the United States could meet a correspondingly larger fraction of its commitment through domestic reductions potentially at lower permit prices.

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[15] (...continued)
policy-induced components.

Trading Scenarios

Intergas Trading

We assumed that trading occurs across all gases based on 100-year global warming potential values.

Trading Blocs

The Administration assessed three different industrialized country trading blocs.

- Annex I implies trading among all Annex I countries.
- Umbrella without Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union and Eastern European countries.
- Umbrella with Eastern Europe refers to trading among a subset of Annex I countries, excluding participation by the European Union.

In addition, we assessed two forms of developing country participation in conjunction with the industrial country trading blocs.

- Developing countries generate emissions credits through the Clean Development Mechanism and sell them internationally. The CDM is assumed to provide 20% of emissions reductions that a country would otherwise undertake if it agreed to a target at business as usual and participated in international trading.
- Key developing countries are assumed to adopt emissions growth targets equal to their 2010 business as usual emissions level and participate in international emissions trading.

Trading across Time

This analysis assessed the permit price in 2010, the midpoint of the first commitment period. Since SGM is a computable general equilibrium model, all outputs are predicated on the full use of the economy's resources, so the analysis implicitly assumes an averaging out of business cycles, weather induced energy use fluctuations, and other short-term phenomena. This smoothing out is consistent with the effect of the five-year averaging period between 2008 and 2012. The permit price

estimates for 2010 therefore provide a reasonable representation of the average permit price over 2008-2012.

Banking

This analysis did not incorporate the banking provision in the Kyoto Protocol. To model banking behavior, it is necessary to know the emissions targets for subsequent commitment periods. Since these targets have not been established yet, any assumption about future emissions targets would be speculative.

Identifying market clearing prices for trading blocs

After developing the baselines and cost functions, we calculated the market clearing prices for the trading blocs. Market clearing prices were estimated by constructing functions for the marginal cost of abatement of greenhouse gas emissions in each trading bloc. Given the greenhouse gas emissions reductions required by the Kyoto agreement for the countries within the trading bloc, these functions allow for the identification of marginal cost of abatement, and the unique price for permits traded among the countries comprising the bloc.

Calculating the Effects on Energy Prices

Reducing greenhouse gas emissions, in particular carbon dioxide emissions, would, in effect, modestly raise energy prices. At the same time, these higher prices would have the effect of reducing energy consumption by a modest amount, as firms and households cut back on some low-value uses of energy. Tradable greenhouse gas permits would also cause some shift in the fuel mix, away from carbon-intensive fuels like coal, and toward carbon-lean and carbon-free fuels, like natural gas, nuclear, and hydropower. Households would hardly notice this fuel mix shift, however, as most of it would occur at power plants.

Summary of Assumptions of Illustrative Analysis

The following list summarizes the assumptions in the illustrative modeling analysis described in the preceding section on methodology.

- Efficient and effective domestic trading of emissions allowances.

- International trading of emissions allowances (within each of three possible blocs).
  - Efficient and effective Annex I trading.
  - Efficient and effective Umbrella trading.
  - Efficient and effective trading with developing countries that adopt emissions targets.

- Trading across all six categories of greenhouse gases.

- Autonomous energy efficiency improvement (AEEI) value of 0.96% per year.

- No banking of emissions allowances to second or later commitment periods.

- Emissions targets are expressed in terms of all six categories of greenhouse gases.

- Marginal abatement costs for carbon dioxide from SGM outputs.

- Marginal abatement costs for non-carbon dioxide greenhouse gases for U.S.

- Marginal abatement costs for non-carbon dioxide greenhouse gases for other countries assumed to be the same as the costs for carbon dioxide.

- No emissions mitigation through carbon sinks for any country included in the analysis (see p. 62).

- No emission reductions from the Administration's electricity restructuring proposal included in the analysis (see p. 64).

- No emissions reductions from the Climate Change Technology Initiative included in the analysis (see p. 64).

- No emissions reductions from industries' voluntary plans through the Administration's industry consultations included in the analysis (see p. 65).

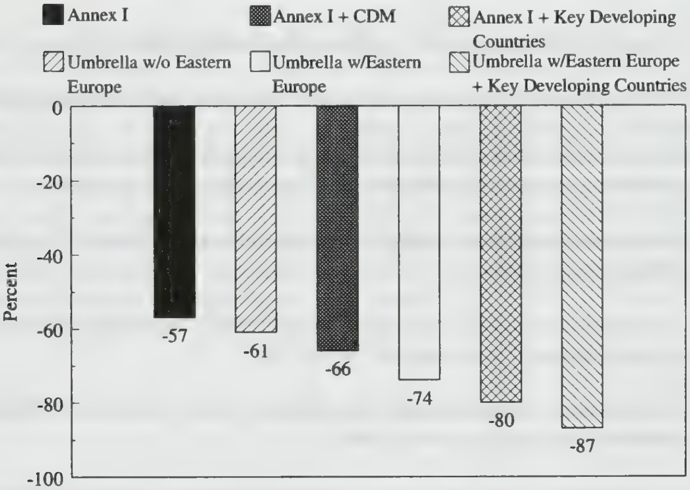
- No emissions reductions from the Federal government's energy efficiency initiative included in the analysis (see p. 66).

- No estimate of the benefits of addressing risks associated with climate change (see p. 69).

Economic Cost of the Administration's Policies to Reduce Greenhouse Gas Emissions in the Illustrative Analysis

The flexibility measures embodied in the Kyoto Protocol and the Administration's climate change approach could dramatically reduce the costs of complying with the Protocol (see Figure 19 and Table 4.) An effective international market for trading emissions permits among industrialized countries -- even without taking into account the added benefit of including key developing countries -- would potentially lower the resource cost to the United States of climate change policy by more than half relative to a scenario in which all abatement is performed domestically and would lower the price for emission permits (expressed as carbon equivalent) by nearly three

Figure 19. Percentage Reductions in Resource Costs Relative to "Domestic Only" Abatement Under Various Trading Scenarios



fourths.[16] If international trading took place only among "umbrella countries" (Annex I except for, in one scenario, the European Union, and, in another scenario, the European Union and Eastern Europe) resource costs could drop by 60-75% as compared to the domestic only cost, while permit prices could drop by 75-85% compared to a "domestic only" approach. Trading among industrialized countries alone could bring costs down into a relatively modest range.

An effective Clean Development Mechanism combined with industrialized country trading could reduce resource costs by two-thirds to four-fifths and could lower permit prices 79 - 88% compared to a domestic only approach. Finally, if some developing countries adopt growth emissions targets and participate in an effective trading system, the total resource cost to the United States could fall by 80 - 87% compared to a domestic only approach, while permit prices could sink by 88 - 93% compared to a domestic only effort.

Table 4. Permit Prices and Resource Costs Relative to "Domestic Only" Abatement of Various Trading Scenarios

Trading Scenario	Percent Reduction in Permit Price (relative to domestic only)	Percent Reduction in Resource Cost (relative to domestic only)
Annex I	72%	57%
Umbrella (with Eastern Europe)	85%	74%
Umbrella (without Eastern Europe)	75%	61%
Annex I + Key Developing Countries	88%	80%
Umbrella (with Eastern Europe) + Key Developing Countries	93%	87%
Umbrella (without Eastern Europe) + Key Developing Countries	91%	83%
Annex I + CDM	79%	66%
Umbrella (with Eastern Europe) + CDM	88%	80%
Umbrella (without Eastern Europe) + CDM	82%	71%

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[16] "Resource cost" refers to the direct cost to the U.S. economy of meeting its Kyoto target measured as the cost of emissions abated domestically plus the cost of purchases of international emissions allowances and emissions credits by U.S. firms. "Permit price" refers to the price paid for a permit to emit one metric ton of carbon equivalent. The permit price can be translated readily into an added increment for U.S. energy prices. See, for example, Table 6.

The Administration supports effective international trading and meaningful participation by key developing countries. An assessment using the SGM model that accounts for effective trading and developing country participation yields permit price estimates ranging between $14/ton and $23/ton, and resource costs between $7 billion and $12 billion/year (see Table 5). The range reflects uncertainty about the extent of Annex I participation in international trading.

Table 5. U.S. Permit Prices and Resource Costs Under the Administration's Policies

Trading Scenario	**Permit Price**	**Total Resource Cost**	**Share of 2010 GDP**
Umbrella with Eastern Europe + key developing country participation	$14/ton	$7 billion/year	0.07%
Annex I + key developing country participation	$23/ton	$12 billion/year	0.11%

The illustrative modeling analysis does not account for several key components of the Kyoto Protocol and the Administration's policies to reduce greenhouse gas emissions. These key issues include the benefits of reducing net emissions through carbon sinks, the Administration's electricity restructuring proposal, the Administration's Climate Change Technology Initiative, the Administration's sectoral consultations to encourage and support voluntary efforts by U.S. industry to undertake emissions reductions, including the provision of credit for early action, and the Administration's efforts to reduce federal energy use. Each of these factors has the potential to significantly increase the amount of reductions made domestically, while lowering the level of permit prices. The model estimates do incorporate the effects of higher energy prices on energy efficiency: results reflect annual rates of energy efficiency improvement of 1.10 - 1.21%, where 0.96% per year is the autonomous energy efficiency improvement and 0.14 - 0.25% is the price-induced energy efficiency improvement. However, any additional payoffs from the CCTI or electricity restructuring are not included in this range. The illustrative model also does not account for ancillary benefits of reducing greenhouse gas emissions, such as improved local air quality, nor does it account for the benefits of averting the risks of climate change (see pp. 66, 69). For a discussion of these cost mitigating factors, see page 62.

U.S. Energy Prices

Under the assumptions of the Administration's analysis, permit prices in the range of $14/ton to $23/ton translate into energy price increases at the household level between 3 and 5%. As Table 6 illustrates, the price increases for electricity and an array of fuels would be modest, and in several cases, the prices faced by consumers, even under the $23/ton permit price, would be lower in real terms than prices experienced today (see Appendix D for long-term energy price trends). By 2010, the increase in energy cost for the average household expected with permit prices between $14/ton and $23/ton would range between $70 and $110 annually, but this would be roughly offset by cost-savings associated with the Administration's electricity restructuring proposal.

Table 6. U.S. Energy Prices Under Permit Prices of $14/ton to $23/ton

Energy Source	**1996 Price**	**2010 BAU Price**	**2010, $14/ton**	**2010, $23/ton**
Electricity	6.9¢/Kwh	5.9¢/Kwh	6.1¢/Kwh	6.2¢/Kwh
Gasoline	$1.225/gallon	$1.259/gallon	$1.293/gallon	$1.314/gallon
Fuel Oil	$1.087/gallon	$1.092/gallon	$1.140/gallon	$1.170/gallon
Natural Gas	$4.25/mcf	$3.80/mcf	$4.00/mcf	$4.13/mcf

All data are in 1996 dollars. 1996 and 2010 BAU prices are from Energy Information Administration 1997a.

The average price of electricity is projected to fall between now and 2010 as a result of competition at the wholesale level, expected declines in coal prices, anticipated efficiency improvements, and falling capital expenditures (Energy Information Administration 1997a). Under business as usual, the average price of electricity in 2010 is projected to be 5.9¢ -- 1¢ below the average price in 1995. Permit prices of $14/ton to $23/ton would yield average electricity prices about 3 to 5% above this projected price of 5.9¢ (see Figure 20). In addition, the Administration's electricity restructuring proposal, by spurring competition at the retail level, is expected to cause electricity prices to fall an additional 10% on average. The electricity restructuring proposal with permit prices of $14/ton to $23/ton would yield electricity prices well below the business as usual projection for 2010 (see Figure 21). Refer to Appendix C for a discussion of the potential cost-savings associated with the Administration's electricity restructuring proposal.

Figure 20. Average U.S. Electricity Prices Under $14/ton to $23/ton Permit Prices, Excluding the Cost-Savings Associated with Electricity Restructuring

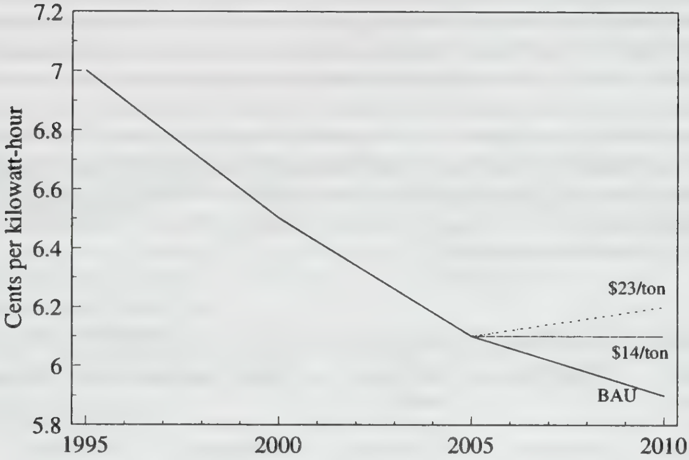
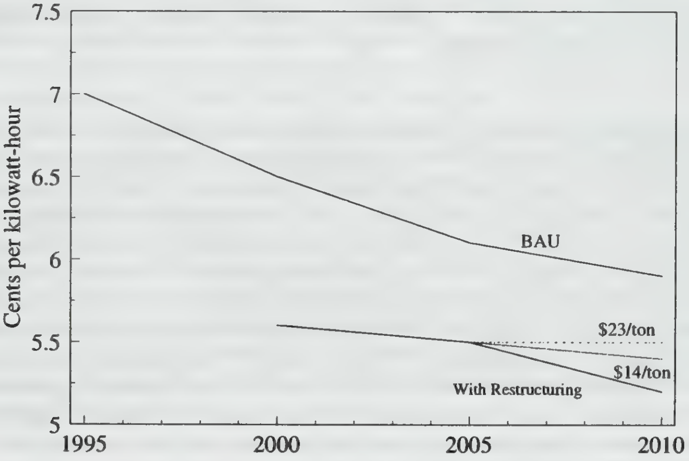
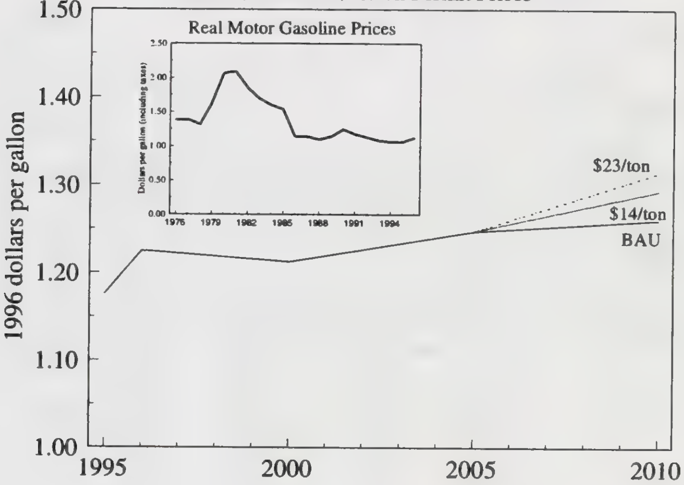


Figure 21. Average U.S. Electricity Prices Under $14/ton to $23/ton Permit Prices, Including the Cost-Savings Associated with Electricity Restructuring



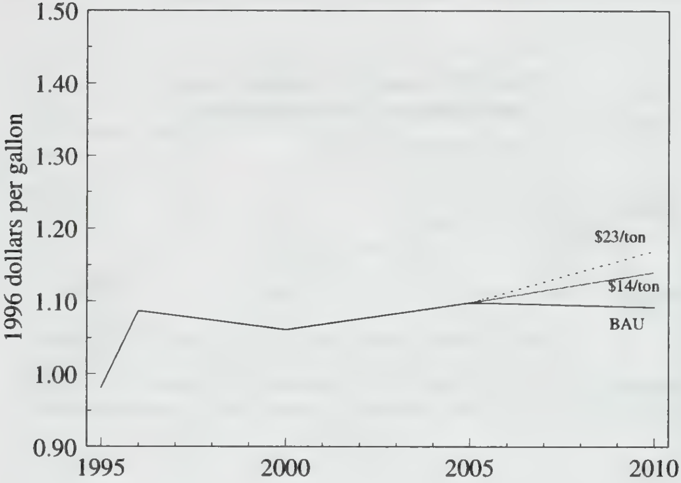
Permit prices of $14/ton to $23/ton also would be expected to increase gasoline prices by 3 to 4%, or 4 to 6¢ per gallon, relative to BAU projections for 2010 (see Figure 22). This increase, which would occur over the next decade, is smaller than the increase in gasoline prices over 1995-1996. Further, this change in gasoline price is small compared to historical changes in gas prices (see inserted figure). Over the past two decades, the average *annual* absolute change in the price of gasoline was 7.5%, about double the projected increase in gasoline prices over 12 years under the assumptions set out here.

Figure 22. Average U.S. Gasoline Prices
Under $14/ton to $23/ton Permit Prices



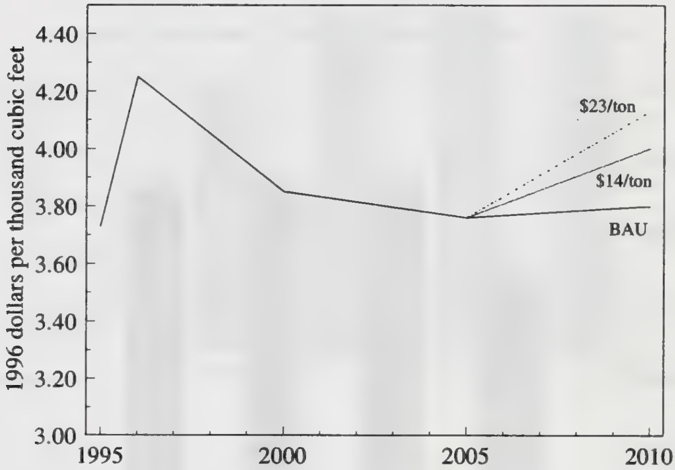
Permit prices of $14/ton to $23/ton could increase fuel oil prices by 5 to 8¢/gallon above their projected price in 2010 (see Figure 23). However, as in the case of gasoline, this increase is smaller, for example, than the jump in fuel oil prices experienced over 1995-1996.

Figure 23. Average U.S. Fuel Oil Prices
Under $14/ton to $23/ton Permit Prices



Between now and 2010, delivered natural gas prices are projected to fall because of anticipated efficiency improvements and an increasingly competitive market (Energy Information Administration 1997a). While greenhouse gas permit prices of $14/ton to $23/ton would likely result in modest increases in the price of natural gas relative to baseline projections, 2010 gas prices would still be below current prices (see Figure 24). Further, the price increases under these permit prices would be smaller than the price increase over 1995-1996.

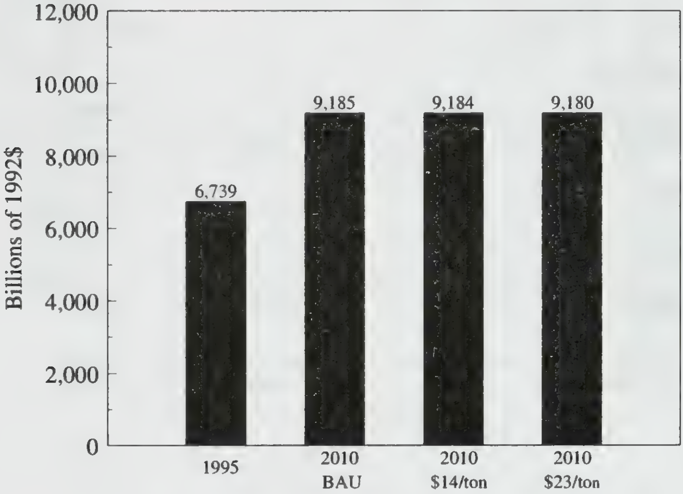
Figure 24. Average U.S. Natural Gas Prices Under $14/ton to $23/ton Permit Prices



U.S. GDP, Investment, and Consumption

The Second Generation Model projects economic growth for the United States in its business as usual scenario through 2010 shown by the difference between the first two bars in Figure 25. Implementing climate policy through effective international trading in conjunction with meaningful developing country participation would have a negligible effect on economic output. A $14/ton permit price would result in a $1 billion (0.01 %) decline in GDP relative to business as usual. Under a $23/ton permit price, GDP would be $5 billion less in 2010 than it is projected to be otherwise.[17]

Figure 25. U.S. GDP Under $14/ton to $23/ton Permit Prices



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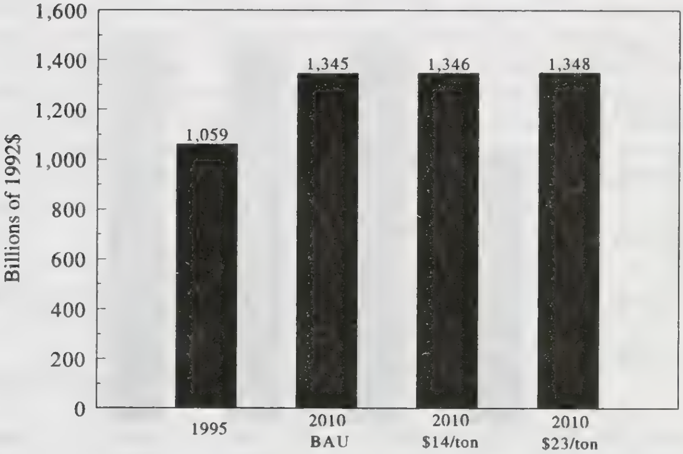
[17] Note that the SGM GDP estimate does not reflect the effects of reducing non-carbon dioxide greenhouse gas emissions.

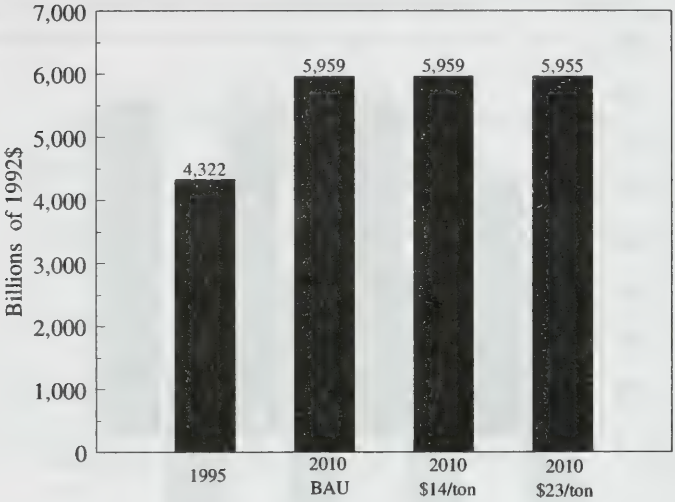
Permit prices of $14/ton to $23/ton imply a small increase in investment relative to business as usual (see Figure 26). Under a $14/ton scenario, investment would increase by $1 billion while a $23/ton permit price scenario entails a $3 billion increase in investment in 2010 relative to business as usual. This increase in investment reflects the adoption of energy efficient and carbon-lean technologies stimulated by the price of greenhouse gas permits.

Figure 26. U.S. Investment Under $14/ton to $23/ton Permit Prices



Permit prices of $14/ton to $23/ton would cause a slight shift from consumption to investment; however, this shift would be small. Under the $14/ton permit price scenario, the change in consumption would be insignificant relative to the business as usual baseline (see Figure 27). Under the $23/ton scenario, the shift would amount to a decline of about $4 billion in 2010.

Figure 27. U.S. Consumption Under $14/ton to $23/ton Permit Prices



Employment

The Second Generation Model is conditioned on the assumption that aggregate employment effects are negligible. Given the small projected energy price increases anticipated and the long lead time before any impact would occur, this assumption is appropriate. Although there may be job gains in some sectors and job losses in others, the analysis of the Kyoto Protocol with effective international trading and developing country participation suggests that there will not be a significant aggregate employment effect under permit prices of $14/ton to $23/ton. Some job loss could occur in energy-intensive sectors, although given the small predicted change in energy prices, impacts in most such sectors are apt to be modest. Further, new jobs will be created in other sectors -- such as in environmental protection technologies, energy production, and energy efficient technologies. Many of these are likely to be high-tech jobs that pay high wages. Nonetheless, as the President said in his October 1997 speech, where dislocations do occur as a result of policies to reduce greenhouse gas emissions, assistance should be provided to affected workers.

Additional Cost Mitigating Factors

Potential Benefits of Carbon Sinks

Various forestry and soil activities sequester carbon dioxide and thereby offset some emissions associated with industrial activity. Trees, other vegetation, and organic matter in soils take up carbon dioxide through photosynthesis and transform the carbon dioxide and store it in vegetative tissue. These carbon sinks can serve as opportunities to mitigate the emissions of carbon dioxide from fossil fuel combustion. For example, the Climate Action Report (1997) reported that gross anthropogenic greenhouse gas emissions in the United States in 1990 were 1,583 MMTCE. However, by including certain carbon sinks,[18] *net* greenhouse gas emissions totaled 1,458 MMTCE, or 8% lower.

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[18] Note that carbon sinks, as defined in the Climate Action Report, are different from the set of forestry activities included in the sinks definition in Article 3.3 of the Kyoto Protocol. While the estimate of sequestration from the Climate Action Report indicates that the United States has been a net sink of carbon, it should not be construed to represent the U.S. carbon sink potential under the Kyoto Protocol. Moreover, the Climate Action Report estimate of carbon sequestration excluded below-ground sinks, such as soil sinks.

The Kyoto Protocol includes opportunities to reduce net emissions through carbon sinks. Certain forestry activities -- afforestation and reforestation net of deforestation -- will be used by countries with emissions targets to meet their commitments (Kyoto Protocol, Article 3.3). The Kyoto agreement does not include carbon sinks in calculating the emissions baseline, but does allow for countries to achieve their targets by accounting for sequestration during the commitment period by these forestry activities that occur between 1990 and 2012. For countries such as the United States, where acres of tree-planting exceed acres of tree-cutting annually, this provision illustrates another opportunity where the United States can reduce net emissions at low cost. In addition, the Protocol provides the option to include additional categories of carbon sinks, like agricultural soils and other land-use change and forestry activities, based on additional technical work and negotiations (Kyoto Protocol, Article 3.4). With these carbon sinks, the United States could more easily meet its target even without additional policies to specifically encourage sink activity. However, given the ongoing negotiations to develop rules regarding carbon sinks, the Administration employed the very conservative assumption that business as usual sink activity generates no net sequestration.

Complementing the opportunities to reduce net emissions domestically through existing forestry activities, several economic analyses indicate that policies could stimulate the creation of additional carbon sinks at low costs. Stavins (1996) derived a marginal cost curve for carbon sequestration for the United States based on his analysis of land use decisions between 1935 and 1984 for a set of counties in Mississippi, Arkansas, and Louisiana. He found that more than 150 MMTCE could be sequestered at $25/ton. Adams et al. (1993) assessed several different scenarios of tree planting on agricultural land and found that about 250 MMTCE could be sequestered at approximately $25/ton.[19] Studies based on engineering/costing models indicate that even more carbon could be sequestered at low costs (Moulton and Richards 1990). While the Administration's illustrative modeling analysis did not incorporate carbon sinks, these studies clearly illustrate the potential for carbon sequestration efforts to play a significant role in meeting our emissions target. These studies provide some evidence that carbon sinks in the United States and other countries could significantly reduce the international emissions trading price and, consequently, the costs of achieving the environmental objective.

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[19] Adams et al. (1993) provide their estimate in short tons, and for purposes of comparison, we have converted this estimate to metric tons.

Potential Emissions Reductions through the Administration's Electricity Restructuring Proposal

The Administration's Comprehensive Electricity Competition Plan (CECP) is estimated to reduce greenhouse gas emissions by about 25 to 40 million metric tons of carbon equivalent per year by 2010. Although competition will lower prices, which will tend to increase consumption, it will also provide a direct profit incentive for generators to produce more electricity with less fuel and improve energy efficiency as competitive sellers seek to maximize the value of their product offerings to buyers by bundling electricity with energy efficiency and management services. In the 2010 timeframe, the net result of retail competition in the absence of additional specific provisions to encourage renewables or subsidize investments in energy efficiency is expected to be nil or a small reduction in emissions.

Specific CECP provisions that will yield additional emission reductions include a renewable portfolio standard, a public benefits fund that will support renewable energy and energy efficiency investments, "green" labeling to help consumers who value clean energy choose it, and a net metering provision encouraging the installation of small renewable systems.

Potential Emissions Reductions through the Administration's Climate Change Technology Initiative

The President's Fiscal Year 1999 budget includes the Climate Change Technology Initiative (CCTI), a $6.3 billion package of tax cuts and R&D investments intended to spur the discovery and adoption of new technologies. The goal is both to stimulate the development of new energy-saving and carbon-saving technologies and to encourage the deployment of those that exist already. Many of the components of the CCTI reflect recommendations made in a recent report by the President's Committee of Advisors on Science and Technology (PCAST 1997).[20] PCAST found that "the inadequacy of current energy R&D is especially acute in relation to the challenge of responding prudently and cost-effectively to the risk of global climatic change from society's greenhouse gas emissions.... Much of the new R&D needed to respond to this challenge would also be responsive to the other challenges" (PCAST 1997, p. i). The report concluded that investments in energy R&D would generate economic and environmental benefits, especially in the long run.

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[20] The President's Committee of Advisors on Science and Technology was established in 1993 to advise the President on matters involving science and technology. PCAST consists of distinguished representatives from industry, academia, research institutions, and other non-governmental organizations.

Building on PCAST's recommendations, the proposed CCTI package contains $3.6 billion over the next five years in tax cuts for energy-efficient purchases and renewable energy, including tax credits of $3,000 to $4,000 for consumers who purchase highly fuel efficient vehicles, a 15 percent credit (up to $2,000) for purchases of rooftop solar equipment, a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a credit up to $2,000 for purchasing energy-efficient new homes, an extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems. The package also contains $2.7 billion over the next five years in additional research and development investments -- covering the four major carbon-emitting sectors of the economy (buildings, industry, transportation, and electricity), plus carbon removal and sequestration, Federal facilities, and cross-cutting analyses and research. One example of the R&D effort is the Partnership for a New Generation of Vehicles (PNGV). PNGV is a government-industry effort to develop attractive, affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In FY99, the combined proposal for PNGV is $277 million, up from $227 million appropriated in FY98. If supported by the Congress, this effort could further improve energy efficiency and lower the cost of meeting our Kyoto target.

The Administration has not included quantitative estimates of emissions reductions associated with the Climate Change Technology Initiative in the modeling analysis. This reflects the uncertainty in calculating the payoffs from funding research and development. A fully funded CCTI would provide for additional U.S. emissions reductions and result in lower permit prices than there otherwise would be.

Potential Emissions Reductions through the Administration's Industry Consultations

Under the Administration's 1993 Climate Change Action Plan, many businesses and institutions are taking voluntary steps to improve their energy efficiency and reduce greenhouse gas emissions. According to the Climate Action Report (1997) the wide array of voluntary actions in that Plan are expected to reduce emissions by 76 MMTCE in the year 2000 and 169 MMTCE in 2010. Annual energy savings are projected to grow to $50 billion (1995 dollars) in the year 2010.

In October 1997, President Clinton called for sectoral consultations which will build on the voluntary efforts undertaken pursuant to the Climate Change Action Plan. One partnership already announced, the Partnership for Advanced Technology in Housing (PATH), sets goals for voluntary improvements in home energy use that would result in an estimated 24 MMTCE in reductions in 2010 while saving consumers $11 billion in home energy expenditures. The Administration will be seeking voluntary agreements with major energy-intensive industries and energy providers to yield further emissions reductions.

As the sectoral consultations are still at an early stage, it would be premature and difficult to incorporate emissions reductions from consultations into the illustrative modeling analysis. Based on the effectiveness of these approaches in the past, these consultations could produce a significant amount of cost-effective action in the coming decade.

Federal Energy Plan

In October, 1997, the President called for a series of steps to reduce energy use in Federal buildings, transportation fleets, and other equipment purchases, and to promote the use of renewable energy sources. As the nation's largest single energy user, the federal government spends nearly $8 billion each year for power to operate facilities, vehicles and industrial equipment, and over 90% of this energy derives from fossil fuels. Long-term savings in cost and energy use can be secured by making sure that purchases for federal facilities, transportation, and systems operations emphasize energy efficiency and that energy-intensive equipment be retrofitted wherever feasible. In addition, the federal government can expand the procurement of renewable and less carbon-intensive fuels.

Ancillary Benefits of Greenhouse Gas Emissions Reductions in the United States

Reductions in fossil fuel combustion typically lead to reductions in conventional air pollutants. These include sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter and volatile organic compounds. These reductions in emissions can have important implications for environmental quality and public health.

To estimate the ancillary benefits for the United States of the Kyoto Protocol, we employed the methods that were used for the Regulatory Impact Analysis (RIA) that the Environmental Protection Agency published in July 1997 for the revised national ambient air quality standards (NAAQS) for particulate matter and ozone. First, the DRI model was used to simulate the changes in fossil fuel combustion by region and economic sector that the Kyoto Protocol would bring about.[21] These changes in fuel consumption were then used by Pechan Associates, an EPA contractor, to estimate changes in emissions of local air pollutants.[22]

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[21] DRI/McGraw-Hill U.S. Energy Model.

Identification of the baseline from which to estimate emission reductions attributable to a carbon control strategy is complicated by the gradual transition to full attainment of the new NAAQS. In particular, states and emission sources could respond to a carbon control strategy by either replacing or maintaining NAAQS-related emission controls. Because of this uncertainty, ancillary benefits are treated as a range.

If ancillary benefits of carbon mitigation make the NAAQS-related emissions controls unnecessary, substantial costs for controlling pollution will be avoided. Reasonable estimates of the cost-savings per ton are approximately $1,620 for NO_x and $700 for SO_2, based on current information about the specific technologies likely to be avoided at utilities and large industrial sources. (These estimates are derived from the estimates of the incremental costs of tighter regional caps on NO_x and SO_2 emissions that were developed for the NAAQS RIA.) Given these unit values, the value of these cost-savings for sulfur dioxide is about $360 to $600 million per year, and for NO_x is about $370 to $610 million per year. Adding these together gives cost savings of about $0.74 to $1.2 billion per year.

If carbon mitigation partially supplements, rather than displaces, NAAQS-related controls, valuing the ancillary health and welfare benefits requires (1) an estimate of the changes in air quality, and (2) an estimate of the value in dollars of such changes. For this analysis we employed the methodologies and tools used for the NAAQS RIA of July 1997. However, we note that in this area, as others, there is substantial uncertainty surrounding the appropriate methodology. The academic literature is in flux and provides a number of possible approaches.

Since the measure of air quality responsible for most of the quantifiable benefits is the abatement of fine particulate matter, we do not quantify changes related to ozone, and concentrate instead on fine particles ($PM_{2.5}$). Reducing $PM_{2.5}$ concentrations yields a wide variety of benefits. Our analysis indicates that the reductions in $PM_{2.5}$ attributable to carbon mitigation that corresponds to the $14/ton case would lead to between $1.1 billion and $5.7 billion in benefits annually. Similarly, the reductions in $PM_{2.5}$ attributable to carbon mitigation in the $23/ton case would lead to between $1.8 and $9.4 billion in benefits. Although these plausible ranges appear large, they are consistent with prior estimates, e.g., in the NAAQS RIA, and reflect a variety of uncertainties in the nature of the health effects.

In this scenario, there are additional ancillary benefits in the form of avoided NAAQS-related air pollutant control costs. Specifically, for the two pollutants governed by cap and trade programs (SO_2 and NO_x)), avoided control costs total about $450 million in the $14/ton case and about $740 million in the $23/ton case. Total annual ancillary benefits for this valuation approach range from about $1.6 billion to $6.2 billion for the $14/ton case and from about $2.5 billion to $10.0 billion for the $23/ton case.

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[22] See E.H. Pechan and Associates 1997a, b.

Thus as a conservative estimate, a quarter of the costs of the Kyoto agreement are offset by these ancillary benefits, although there is substantial uncertainty about these estimates.

It should be noted that the level of ancillary benefits from carbon mitigation increases with the extent of domestic mitigation and decreases to the extent that mitigation is based on purchasing international emissions allowances. In general the magnitude of these ancillary benefits depends on the type of regulation of air quality and emissions of local air pollutants, as well as baseline local air quality.

Greenhouse gas mitigation strategies will result in additional reductions of other air pollutant emissions, including several that have not been quantified (see Table 7). In particular, greenhouse gas mitigation strategies will result in additional reductions in heavy metals, acetaldehyde, formaldehyde, organic aromatics, polycyclic aromatic hydrocarbons (PAH), and chlorinated dioxins and furans. These substances are capable of producing a wide array of health and environmental effects, including some forms of cancer. Exposure to these substances at some concentrations can cause effects in addition to cancer; these may range from respiratory problems to reproductive and developmental effects. Further, although reductions in nitrogen and sulfur dioxide emissions were quantified in dollar terms, the estimated values exclude the mitigation of adverse impacts on agricultural and forestry yields, aquatic and terrestrial ecosystems, and recreational fishing.

Table 7. Unquantified Ancillary Emissions Benefits

Effect Category	**Effects**	**Other Possible Effects**
Human Health	Cancer Mortality Non-cancer Effects -neurological -respiratory -reproductive -hematopoietic -developmental -immunological -organ toxicity	
Ecological	Effects on: -wildlife -plants -ecosystem -biological diversity	Loss of habitat for endangered species
Welfare	Decreased recreation opportunities Decreased agricultural yield Decreased visibility	Loss of biological diversity Building deterioration

Benefits of Averting Climate Change

In conducting this analysis, the Administration has not attempted to quantify the benefits of mitigating the risks of climate change. While several economists have estimated the damages of global warming under a doubling of atmospheric concentration (Cline 1992; Fankhauser 1993; Nordhaus 1994), they all assumed an endpoint -- an atmospheric concentration, and subsequently, an increase in global temperature. However, the Kyoto Protocol only stipulates an emissions path through 2012. To calculate the benefits of averting climate change-induced damages, it is necessary to know the emissions path for many years beyond 2012. Thus while the benefits of getting started on the Kyoto path to reducing greenhouse gas emissions may be quite large over time, we cannot estimate these benefits without knowing where the path goes in the years after the Kyoto compliance period.

Cline (1992) assessed the economic damages from warming associated with two temperature increases: 2.5° C (4.5° F) and 10° C (18° F). He presented the former temperature change as the likely effect of a doubling of the atmospheric carbon dioxide concentration and the latter temperature change as the result of "very long term warming." Under the scenario where the temperature increases 4.5° F, Cline found that the annual damage to the United States would be about 1.1% of GDP, or about $89 billion in today's terms.[23] Cline's "very long term warming" scenario resulted in economic damages of about 6% of GDP.

Cline's estimates of annual economic damage of global warming take account of the following categories of impact: agriculture, forest loss, species loss, sea-level rise (including costs of constructing dikes and levees, wetlands loss, and drylands loss), electricity requirements, non-electric heating, human amenity, human life, human morbidity, migration, hurricanes, construction, leisure activities, water supply, urban infrastructure, and air pollution. Cline provides only qualitative assessments for several categories. In addition, he found that non-electric heating expenditures decline with global warming, so this is actually considered a benefit, not a cost, associated with warming.

The economic damage under a doubling of the atmospheric carbon dioxide concentration found by Cline is not significantly different in magnitude from the results of Nordhaus (1994) and Fankhauser (1993). Nordhaus estimated that a temperature increase of 5.4° F would result in annual costs of about 1% of GDP. Fankhauser found that under the same 5.4° F temperature increase the annual costs of warming would be about 1.3% of GDP for the United States, and 1.5% of GDP worldwide. However, the similarity among the aggregated estimates of these three researchers masks both the differences in their methodologies and the true uncertainty associated with long-term forecasts of the damages from given increases in global warming. Different researchers account for different categories of damages, and even within the same category, they may estimate different effects. More importantly, the estimates are all fundamentally based on extrapolations from current and past experience, and may not fully incorporate effects that will become apparent only with future experience.

International Impacts Associated with Reducing Greenhouse Gas Emissions

Just as in the United States, all Annex I countries would benefit significantly from effective implementation of the Kyoto Protocol's flexibility mechanisms. Further, Non-Annex I countries would accrue three kinds of benefits: 1) under international trade with binding targets slightly below business as usual and the CDM, they will enjoy economic gain from trade in emissions allowances; 2) reductions in carbon emissions will reduce emissions of local air pollutants; and 3) contributing to lower global greenhouse gas emissions would further reduce the risks of climate change, to which they are, in many cases, the most vulnerable and the least able to adapt.

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[23] Cline's original estimate is quoted in 1990 dollars. The figure given above translates the Cline estimate into 1997 terms by scaling it to 1997 GDP.

- **Economic benefits:** With growth targets, developing countries could enjoy substantial net gains through the international sale of emission reductions achieved at lower cost than the world price. Such participation by developing countries in international emissions allowance markets would lower the costs to industrial countries, including the United States, of meeting their Kyoto targets. In particular, costs would be lower than with trading among only Annex I countries. On a project-by-project basis, the Clean Development Mechanism would also result in net gains to developing countries and cost-savings to industrial countries. Given the anticipated difference in scale, a system including effective trading of developing countries' emissions would yield greater gains to developing countries and greater cost-savings to industrial countries than the Clean Development Mechanism.

- **Environmental benefits:** Developing country growth targets would lower global greenhouse gas emissions relative to a world with only Annex I targets. To the extent that these lower global emissions further reduce the risks of climate change, the more vulnerable developing countries would benefit. Further, reducing carbon dioxide emissions generates ancillary air quality benefits by reducing emissions of particulate matter, sulfur dioxide, and nitrogen oxides. By adopting a growth target and engaging in trading, developing countries could achieve environmental benefits not achievable by pursuing CDM alone.

Effects of Climate Change Policy on U.S. Competitiveness

Some have expressed concern that the Kyoto Protocol might adversely affect the competitive position of American industry. In general, structural changes in the economy have the effect of expanding some sectors and contracting others. But to provide some perspective on this issue, consider the following facts. First, on average, energy constitutes only 2.2 percent of total costs to U.S. industry. Second, energy prices already vary significantly across countries. For example, premium gasoline cost $1.28 per gallon in the United States in 1996, but only 8 cents per gallon in Venezuela. Similarly, gas prices were $3.71 per gallon in Switzerland and $4.41 per gallon in France (Bureau of the Census 1997). Electricity prices also vary significantly: in the U.S., for industry, they were 5 cents per kilowatt hour in 1995, a fraction of prices in Switzerland of 13 cents per kilowatt hour (OECD/IEA 1996). Yet U.S. industry did not move en masse to Venezuela, nor did Swiss industry move to the United States. Third, roughly two-thirds of all emissions are not in manufacturing at all, but in transportation and buildings, sectors which, by their very nature, are severely limited in their ability to relocate to other countries.

Evaluating how the Kyoto Protocol could affect competitiveness of a few specific manufacturing industries -- especially those that are energy-intensive, such as aluminum and chemicals -- is complex. However, the modest energy price effects associated with permit prices of $14/ton to $23/ton would likely have little impact on competitiveness.

Further, there is no reason to expect that mitigating climate change would necessarily have a negative effect on the trade balance. Indeed, the efforts to reduce greenhouse gas emissions would likely decrease oil exports to the United States, benefitting the trade balance. In short, we believe that the reason we need developing country participation is primarily because the problem is global and cost-effective solutions are essential, rather than to avoid adverse effects on competitiveness.

Next Intergovernmental Panel on Climate Change (IPCC) Plenary and List(s) of Key Policy-Relevant Questions and Key Policy-Relevant Scientific Questions

Q36. It is my understanding that at the last Plenary meeting of the Intergovernmental Panel on Climate Change (IPCC), the Parties agreed that: (1) the next Assessment Report would once again include a Synthesis Report (Report) for policy makers; (2) the Report will be prepared by a country team composed by the IPCC Bureau; (3) the Report is not a scientific document, but a governmental document; (4) the Report "will address a broad range of key policy-relevant questions"; and (5) the IPCC Chairman and the Working Group Chairs will develop a list of "key policy-relevant scientific questions" that is to be circulated to governments for comment and for IPCC approval at its next plenary.

Q36.1 Is my understanding as stated above correct, and if not, what is the correct information?

A36.1 At the IPCC's 13th Plenary Session in the Maldives in September 1997, the Parties agreed that the next Assessment Report would include a synthesis report. The synthesis report will be prepared by a drafting team composed of the IPCC Chair, the Co-Chairs of the IPCC'S three working groups and additional experts. The report will be a scientific document in that it will synthesize and integrate policy-relevant scientific and technical information contained in the three working group reports. The report will address a broad range of key policy-relevant questions. These policy relevant questions will be agreed by governments this fall at the IPCC's 14th Plenary Session) based on a list submitted by the U.N. Framework Convention on Climate Change, which was compiled from submissions by Parties (governments) to the Convention. Once adopted by the IPCC plenary, the list of policy-relevant questions will be changed only with the agreement of the IPCC plenary.

Q36.2 What is the schedule for the next IPCC plenary?

A36.2 The IPCC's 14th Plenary Session will take place in Vienna, Austria, from October 1-3, 1998; it will be preceded by a meeting of the IPCC's Bureau on September 28, and by meetings of the IPCC's three working groups on September 29-30.

Q36.3 Is the list of the "broad range of key policy-relevant questions" to be addressed by the Report and the list of "key policy-relevant scientific questions" to be developed by the IPCC Chairman and the Working Group Chairs the same list or are they separate lists?

A36.3 There is only one list of policy-relevant questions. That list will be agreed by governments at the IPCC's 14th Plenary, based on a list submitted by the U.N. Framework Convention on Climate Change, which was itself compiled from questions identified by Parties (governments) to the Convention.

Q36.4 What is the status of the list(s)?

A36.4 Please see response to question 36.1 and 36.3 above.

Q36.5 Please provide a copy of (1) the list(s) when received, and (2) your comments thereon when submitted.

A36.5 A copy of the list developed by the Subsidiary Body on Scientific and Technological Advice (SBSTA) and adopted at the October 1997 SBSTA meeting in Bonn, that has been forwarded to the IPCC for consideration at its 14th Plenary is attached. Satisfied that the list identified a full range of policy-relevant questions, the United States produced no written comments on it. *(The relevant document, "TAR Synthesis Report," IPCC-XIV/Doc. 8 (25-VIII-1998), Submitted by the Chairman, August 24, 1998, Intergovernmental Panel on Climate Change, Fourteenth Session, Vienna, 1-3 October 1998 follows.)*

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INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

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INTERGOVERNMENTAL PANEL
ON CLIMATE CHANGE

IPCC-XIV/Doc. 8
(25-VIII-1998)

FOURTEENTH SESSION
Vienna, 1-3 October 1998

ENGLISH ONLY

TAR SYNTHESIS REPORT

(Submitted by the Chairman)

> The Panel may recall that it agreed at the Thirteenth Session (Maldives, 22 & 25-28 September 1997) on the procedure for adopting the Summary for Policymakers (SPM) of the Synthesis Report. It deferred action on the adoption procedure for the report underlying the SPM. It agreed that it should approve the list of policy-relevant scientific-technical questions to be addressed in the Synthesis Report. It further agreed that the Bureau could approve the composition of the writing team for the Synthesis Report.

IPCC Synthesis Report

Proposal by
Robert T. Watson
Chairman of the IPCC

1. This paper contains five sections:
   - philosophy - already approved in the Maldives;
   - structure - already approved in the Maldives;
   - approval process - partly approved in the Maldives;
   - writing team composition - partly approved in the Maldives;
   - development process - approved in the Maldives;
   - suggested outline/policy relevant scientific questions - to be reviewed and approved.

2. The Panel is requested to make three decisions:
   - approval process for the longer paper;
   - structure of the report;
   - approval of policy relevant scientific questions.

3. The IPCC Bureau must approve the composition of the writing team.

4. Philosophy

4a. The Synthesis Report will be written in a non-technical style suitable for policymakers and will address a broad range of key policy-relevant scientific questions that are of greatest interest and importance to policymakers, in particular, the Conference of Parties to the FCCC and its two subsidiary bodies, SBI and SBSTA (decision 4.1).

4b. The Synthesis Report should synthesize/integrate material contained within the assessment reports of the three Working Groups (decision 4.4).

4c. The Working Groups will be asked to include assessment information relevant to those key policy-relevant scientific questions in their contributions to the TAR and to bring forward the key points in their Summaries for Policymakers (decision 4.3).

5. Structure

5a. The Synthesis Report should consist of a short SPM and a longer report (decision 4.5).

6. Approval Process

6a. The SPM of the Synthesis Report will undergo a simultaneous expert/government review, and then be approved line by line by the IPCC (decision 4.6). The adoption process for the longer portion of the Synthesis Report was deferred in the Maldives.

6b. There were two schools of thought in the Maldives:

School 1: The longer report would be subjected to an expert/government review and then be accepted by the IPCC;

School 2: The longer report would be subjected to an expert/government review and then line-by-line approval by the IPCC.

6c. Many of you will remember that Bert Bolin and I both favoured the first approach. Our argument was that it would not be feasible to approve a 30-50 page report line-by-line by the IPCC sitting in a plenary session, and that a 30-50 page report was needed to answer the policy-relevant scientific questions identified by governments and SBSTA.

6d. If we cannot come to agreement on one of the above options, I would like to suggest three possible options, remembering that the scope of the Synthesis Report, i.e., policy-relevant scientific questions, will be approved by the IPCC, and that the Synthesis Report should synthesize/integrate material contained within the assessment reports of the three Working Groups, which will include approved SPMs and accepted underlying reports.

Approach 1: The approval process for the longer report has three elements: (i) an expert/government review; (ii) acceptance by the IPCC; and (iii) the SPM would have an Annex for any dissenting views by governments.

Approach 2: The approval process for the longer report has three elements: (i) an expert/government review; (ii) approval by the IPCC Bureau, similar to the Technical Papers; and (iii) acceptance by the IPCC.

Approach 3: The approval process for the longer report has four elements: (i) an expert/government review; (ii) approval by the IPCC Bureau, similar to the Technical Papers; (iii) acceptance by the IPCC; and (iv) the SPM would have an Annex for any dissenting views by governments not represented on the Bureau.

6e. Approaches 2 and 3 give a very important role to the IPCC Bureau, which is in my opinion an appropriate role given that it was elected by the IPCC and is a geographically representative body.

6f. I have polled the IPCC Bureau and the majority believes that we should either adopt School 1 or Approaches 1 or 3.

7. Writing Team Composition

7a. The IPCC Chair will chair a geographically balanced writing team for the Synthesis Report, with the writing team composition being agreed by the IPCC Bureau (decision 4.7).

7b. The following two options will be presented to the IPCC Bureau for their consideration. The IPCC will be informed of their decision.

7c. A writing team of 21 comprising of:

- the IPCC Chair;

- the five IPCC Vice-Chairs: Meira, Izrael, Pachauri, Odingo and Seiki;
- the six WG Co-Chairs: Ding, Houghton, Canziani, McCarthy, Davidson and Metz;
- nine lead authors: three from each WG - to be nominated by WG Bureaus (at least one developing country expert per WG).

or

A writing team of 15 and 6 review editors comprising of:

- the IPCC Chair;
- two IPCC Vice-Chairs;
- three WG Co-Chairs ;
- nine lead authors: three from each WG - to be nominated by WG Bureaus (at least one developing country expert per WG).

The remaining Vice-Chairs and WG Co-Chairs would be the Review Editors.

The IPCC Secretary, the heads of each of the Working Group TSUs and the technical advisor to the IPCC Chair shall be resource persons to the writing team.

8. **Development Process**

8a. The IPCC Chairman and the Working Group Co-Chairs will develop a list of key policy-relevant scientific questions in consultation with the President of the Conference of the Parties (COP) and the chairs of the subsidiary, and other, bodies of the COP, using the mechanism of the IPCC/FCCC Joint Working Group. The list will be circulated to governments for comment and the IPCC will approve the list at its Fourteenth Session. This list can be revised at a later date under the responsibility of the IPCC Chair, and with the approval of the IPCC (decision 4.2).

8b. Last year, the IPCC requested input from governments through SBSTA and SBI and received a number of useful suggestions. Additional suggestions were requested by the IPCC Chair at the SBSTA meeting this year.

9. **Suggested Structure**

- ***Summary for Policymakers (5 pages)***

- ***Introduction*** - to place the document in context of other elements of the Third Assessment Report, i.e., the WG Reports, including their Summaries for Policymakers, and the Technical Papers and Special Reports ((i) Aviation and the Global Atmosphere; (ii Methodological and Technological Issues Related to Technology Transfer: Opportunities for Technology Co-operation; (iii) Emissions Scenarios of greenhouse gases and aerosol precursors; and (iv) Land Use, Land Use Change and Forestry) commissioned since the Second Assessment Report - 1 page;

- ***Key Conclusions from WGs I, II and III*** - highlight some of the key conclusions from each of the Working Groups, emphasizing where possible the regional implications of climate change - 4 pages;

- *Key Policy-Relevant Scientific Questions* - to highlight the key policy-relevant findings in the form of providing scientific and technical information to a short series of policy-relevant scientific questions that are mostly not WG-specific - 45 pages.

10. Policy Relevant Scientific Questions

10a. The suggested list of policy-relevant scientific questions are based on the excellent input IPCC received from a large number of governments through SBSTA, and should provide the scientific and technical input required by governments. Some of the suggested questions were too detailed for the Synthesis Report and will be addressed in the relevant Working Group SPM. Given that many of the government suggestions were similar, an attempt has been made to combine them as appropriate, hence some (government) original wording has been changed. In addition, the wording of some questions has been modified given they were worded as policy questions rather than policy-relevant questions. A few of the questions only require information from a single IPCC Working Group, while most of them require information from more than one Working Group.

Q1: What further progress has been made in the detection and attribution of climate change, at both the regional and global scale? (WG I)

Q2: What progress has been made in determining the possible interactions of anthropogenic climate change with major causes of climate variability such as the El Niño-Southern Oscillation? (WG I)

Q3: What are the implications of rapid rates of warming? (WGs I & II)

Q4: What is the potential for positive feedbacks from climate change to increase greenhouse gas concentrations and climate change beyond the range identified in the non-intervention scenarios provided to the TAR by the Special Report on Emissions Scenarios? (WGs I & II)

Q5: Given the possibility of positive feedbacks, what insight can IPCC provide in the risks associated with the range of global emission trajectories to allow decision-makers to place these in the context of "dangerous anthropogenic interference with the climate system"? (WGs I & II)

Q6: Where possible, identify the risks of "surprises" in particular in the form of rapid and or irreversible changes to the climate system. Can thresholds for severe impacts, climate instability etc. be identified for different greenhouse gas concentrations and rates of change, which might give some insight into consideration by decision-makers of "dangerous levels" of greenhouse gas concentrations? (WGs I & II)

Q7: What policies and steps should be taken by developed countries for the transfer of technologies to developing countries and how can such transfers be accomplished? (WG III and the Special Report on Methodological and Technological Issues Related to Technology Transfer: Opportunities for Technology Co-operation)

Q8: What new insights have emerged in order to evaluate the economic and social impacts of climate change response options (energy and non-energy mitigation and adaptation), taking into account different decision-making frameworks, such as cost-benefit analysis? (WG III and Special Report on Land Use, Land Use Change and Forestry)

Q9: What is projected to occur with no action (Kyoto Protocol not ratified), implemented actions, and agreed and proposed targets and timetables (e.g., Kyoto Protocol ratified) to mitigate climate change (WGs I, II & III):

- emissions of greenhouse gases and aerosols (WG III);
- projected changes in atmospheric concentration, radiative forcing, climate, and sea level at the regional and global level (WG I);
- the impacts of the projected changes in climate and sea level on human health, ecological systems and socio-economic sectors (particularly agriculture and water) at the regional and global level (in the context of other socio-economic changes), and options for adaptation (WG II);
- the development, sustainability and equity issues associated with the projected impacts and adaptation options for developed and developing countries at a regional level (WG II);
- the technologies, policies and measures that can be used for agreed and proposed targets and timetables (WG III);
- the development, sustainability and equity issues for developed and developing countries at a regional level associated with mitigation (WG III);
- what are the effects of Annex I obligations (policies and measures) on all countries, e.g., taking into account trade effects within and outside Annex I countries and production and prices of fuels and energy intensive goods (WG III)?

Q10: What are the climatic, impact, environmental, social and economic consequences of different stabilization levels of greenhouse gas concentrations (between 350 and 750 ppm) and what are the technologies, policies and measures for emissions and sinks that can be used (and at what cost) to realize different stabilization levels? For each stabilization level of greenhouse gases, taking into consideration aerosols, and for different time profiles, taking into account different rates of change (WGs I, II & III) discuss:

- projected changes in climate and sea level at the regional and global level (WG I);
- the impacts of the projected changes in climate and sea level on human health, ecological systems and socio-economic sectors (particularly agriculture and water) at the regional and global level, and options for adaptation (WG II);
- the development, sustainability and equity issues associated with the projected impacts and adaptation options (WG II);
- the combination of technologies, policies and measures for emissions and sinks that can be used to achieve stabilization of greenhouse gas concentrations at different levels and for different time profiles, taking into account different rates of change (WG III);
- the development, sustainability and equity issues associated with achieving stabilization of greenhouse gas concentrations at different levels and for different

constraints on rates of change, including, what would be the effects of potential Annex I obligations (policies and measures) on all countries, e.g., taking into account trade effects within and outside Annex I countries and production and prices of fuels and energy intensive goods (WG III).

Q11: What are the significant interactions between climate change and other local (e.g., urban pollution), regional (e.g., acid deposition) and global (e.g., loss of biological diversity and land degradation/desertification) environmental changes, and what are the implications of these interactions for policy response strategies and economic and social costs? (WGs I, II & III)

Q12: How can optimal emissions pathways be defined using different decision-making frameworks? (WGs I, II & III)

Q13: Which findings are the most robust, and what are the main uncertainties and factors in quantifying the projected changes in climate, the impacts of climate change, and the consequences of different mitigation and adaptation policies? (WGs I, II & III)

Changes to Intergovernmental Panel on Climate Change (IPCC) Procedural Rules

Q37. I also understand that IPCC has agreed that the Synthesis Report should consist of a short Summary For Policy Makers (SPM) and a longer report, but that, due to opposition by China, Kenya, the Russian Federation and others—but not the U.S.—over proposals to limit the line-by-line approval to the short SPM only, no decision has been made on the issue of line-by-line approval by the IPCC even though the IPCC procedural rules require such line-by-line approval.

Q37.1 Is my understanding as stated above correct, and if not, what is the correct information?

A37.1 Please see the response to your letter of August 7, 1998 on this issue.

Q37.2 Please explain the reasons why the U.S. delegation did not apparently support fully the views of these other governments that the entire Synthesis Report, which is a governmental document with political overtones, be subject to line-by-line approval.

A37.2 Please see the response to your letter of August 7, 1998, on this issue.

Q37.3 I understand that Dr. Robert Watson, the current Chair of the IPCC has objected to a line-by-line review of the entire Synthesis Report because of length of time such a review could require. Why should the time required for an adequate line-by-line review of the entire Synthesis Report be a sound basis for the U.S. not joining China and other nations in insisting on a line-by-line approval, given past IPCC controversies and given the potential for significant governmental and public policy impacts?

A37.3 Please see the response to your letter of August 7, 1998, on this issue.

Q37.4 Does the U.S. support or oppose any changes to the IPCC rules?

A37.4 As a general matter, the United States supports many of the proposed changes to the IPCC rules, which were first adopted in late 1992 when the IPCC began work on its Second Assessment Report, and which have been amended from time to time since then. In our view, certain changes are necessary to streamline the procedures and adapt them to the approach that the IPCC will follow in preparing its Third Assessment Report, which will be completed in mid- to late 2001.

Q37.5 If the U.S. supports or opposes any changes to the IPCC rules, please identify which changes you support or oppose and why.

A37.5 While in general we support many of the proposed changes to the IPCC rules, we have not yet completed our review of the draft that will be taken up at the IPCC's 14th Plenary; thus, we are not able at this time to provide a precise list of our views with respect to each proposed change.

F. JAMES SENSENBRENNER, Jr., Wisconsin, CHAIRMAN

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August 7, 1998

The Honorable Stuart E. Eizenstat
Under Secretary of State for Economic, Business
and Agricultural Affairs
U.S. Department of State
2201 C Street, NW
Washington, DC 20520

Dear Under Secretary Eizenstat:
Stu

More than four months have lapsed since I submitted for your early reply a series of "Post Hearing Questions" concerning the Kyoto Protocol and related matters, and I have not received an adequate explanation for the long delay. A number of questions were important to our understanding of the U.S. position on issues that were to be discussed at the June 1998 Bonn meeting of the U.N. Framework Convention on Climate Change (FCCC) Subsidiaries Bodies. I once again request a response to those questions.

Two of the Post Hearing Questions, numbers 38 and 39, asked about pending actions of the Intergovernmental Panel on Climate Change (IPCC). I understand that the IPCC and its Working Groups are scheduled to meet during the week of September 28, 1998 in Vienna, Austria. Two matters on the IPCC's Provisional Agenda that are also addressed in my questions are: (1) the Synthesis Report (SR) of the Third Assessment Report and (2) the closely related issue of possible amendments to the IPCC's rules of procedure which are currently called "Principles and Procedures," but are, I understand, being proposed to be called only "Guidelines" for preparing, reviewing, accepting, approving, and publishing IPCC reports.

With regard to the SR, the provisional agenda states:

> *"The [IPCC] Panel may recall that it deferred action on the procedure to accept/approve the document or report that will underlie the Summary for Policy makers (SPM) of the Synthesis Report. The Panel may further recall that it decided that the SPM should be approved line-by-line. The Chairman will submit for the consideration of the Panel and its decision his views on the adoption of the underlying report.*

> *"The Chairman will also brief the Panel on his views on policy-relevant scientific/technical questions that could be included in the Synthesis Report.*
>
> * * * *
>
> *"Amendments proposed by the IPCC Ad-Hoc Group on Procedures were initially circulated to governments for comments on 15 May 1998. They were revised based on the comments received and have been circulated to the governments a second time. The Chairman of the Ad-Hoc Group, Mr. David Warrilow of the UK, will brief the Panel on the revised proposals.*
>
> *"The Chairman of the IPCC will establish a Committee of the Whole under his chairmanship to discuss the amendments and to make proposals for adoption by the Panel."*

It is my understanding that the IPCC Chairman, despite the requirements and long-standing policy of the current IPCC rules of procedure, strongly favors limiting line-by-line approval by governments solely to the Summary for Policymakers portion of the SR. As to the underlying report, he wants governments, including the U.S. government, to be satisfied with the work of its preparers and to abandon the current requirement of the IPCC rules for line-by-line approval by governments of the entire SR. Reportedly, his primary reason for such abandonment is that it takes too much of the IPCC's time to conduct such a review and that the SR is, after all, based on the underlying working group reports.

The proposed agenda calls for the IPCC Plenary to act on the SR issue before there is consideration of the proposals to change the rules of procedures. That apparently means that if the IPCC adopts the Chairman's "views" on the SR, the IPCC would have to make corresponding rules changes in order to conform the rules to the prior action.

That is a "cart before the horse" approach. It has always been my understanding that a governmental body must abide by their rules until changed. That is certainly the rule of law for Federal agencies in the United States, including the State Department. Apparently, that is not the case in the WMO/UN System of which the IPCC is a part. Whatever the practice, the U.S. delegation should insist that the IPCC abide by its rules until changed through proper procedure.

The SR is not a scientific document. It is an "intergovernmental document" that has significant policy implications, or, as the IPCC Chairman often says, "policy-relevant" implications, for governments and the public. The United States should not agree to IPCC rules changes that would take away that important right of governments which is also a safeguard for the public.

I believe that the U.S. delegation should, like China, the Russian Federation, and several other countries, insist on line-by-line approval of the entire SR, as well as the Policymakers Summary. If time is the concern of the Chairman, then the answer is to shorten both the Summary and the Report, particularly since there also will be summaries of each of the reports of the Working Groups. Should you disagree with my view, I request that you explain in detail why you disagree.

The Provisional IPCC agenda for Vienna proposes to create a different kind of SR than the one specified in the current IPCC Rules of Procedure. Those rules state:

> *"The Panel will base its Synthesis Report on a review of the Working Groups' Summaries, will record any substantial disagreements not already taken into account and will include the Summaries in its report.*
>
> *The IPCC Synthesis Report is intended to provide an overview and synthesis of the Executive Summaries and the Summaries for Policymakers of the Working Groups. It should receive full review by participating government and organizations."*

The new procedures for the SR proposes to delete the above procedures and replace them with the following:

> *"The Synthesis Report should consist of a short Summary for Policymakers and a longer report and will synthesise/integrate material contained within the assessment reports of the Working Groups. It should be written in a non-technical style suitable for policymakers and will address a broad range of policy-relevant questions."*

After a protracted debate at the IPCC Plenary session in Rome in 1995, I am advised by my staff, who attended that session, that the SR of the Second Assessment Report was approved line-by-line as a document representing an "overview and synthesis of the Executive Summaries and the Summaries for Policymakers of the Working Groups". Efforts to expand the SR beyond those borders were strongly resisted as putting at risk the credibility of the agreed upon scientific assessment by attempts to stretch "policy-relevant" summaries of underlying scientific information into "policy-prescriptive" statements.

It is now proposed that the "new" SR will "address a broad range of policy-relevant questions" supplied by the FCCC Subsidiary Body for Scientific and Technological Advice, the European Union and others before the Third Assessment Report has been drafted. This suggests that the SR and the whole Third Assessment Report will be drafted with a view to answering certain "policy- relevant" questions instead of being a full assessment of the state of the science of climate change and related socioeconomic impacts. Does the U.S. support these rule changes and this "new" kind of SR? If so, please explain why.

What are those "policy-relevant" questions? Has the U.S. reviewed all of those questions and concurred in them? How? When?

When will the SR be prepared, be subject to review, and be released? Is this to occur, as in the past, as part of the Third Assessment Report? If not, what is its purpose? Is the IPCC creating a new report that is separate from the assessment?

Also, please explain why the IPCC Rules of Procedure are proposed to be designated as "Guidelines." Does this change mean or imply that such "Guidelines" are not binding on the IPCC, its Chairman, or the lead authors? If no, what does it mean or imply? Does the U.S. support that apparently significant change?

In addition to the above, I request your response to the enclosed additional questions concerning the June 1998 Bonn meeting of the FCCC Subsidiary Bodies. The response should also include a copy of the draft Procedures of May 15, 1998 and the subsequent versions that were "circulated to governments a second time," together with the U.S. comments on both versions.

I request your full and complete reply to all of these matters not later than August 31, 1998.

Sincerely,

F. JAMES SENSENBRENNER, JR.
Chairman

FJS/hlw

Enclosure

COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Hearing
on

The Road from Kyoto—Part 3: State Department Overview

Thursday, March 5, 1998

Post-Hearing Questions
Submitted to

The Honorable Stuary E. Eizenstat
Under Secretary of State for Economic, Business and Agricultural Affairs
U.S. Department of State

Additional Post-Hearing Questions Submitted by Chairman Sensenbrenner on August 7, 1998

Omission of 1990 Carbon Dioxide Emissions for Croatia, Lithuania, Slovenia and the Ukraine from Table on page 60 of document FCCC/CP/1997/7/Add. 1

Q1. Annex B to the Kyoto Protocol lists the 39 Parties subject to Protocol's Article 3 commitments, and this list includes Croatia, Lithuania, Slovenia and the Ukraine. However, a table of calculations ("Total carbon dioxide emissions of Annex I Parties in 1990, for the purposes of Article 25 of the Kyoto Protocol"), which was not adopted in Kyoto as part of the Protocol, was prepared by the FCCC Secretariat and included as page 60 of document FCCC/CP/1997/7/Add. 1. That table lists only 34 of the Annex B Parties, and does not include Croatia, Lithuania, Slovenia and the Ukraine.

Q1.1 Please explain why these four Parties (Croatia, Lithuania, Slovenia and the Ukraine) are not included in the Secretariat's table of calculations.

A1.1 These countries were not included because they had not submitted any data about their 1990 emissions; thus, the Secretariat could not provide data as it did for the other listed countries. Note that both Ukraine and Lithuania have subsequently submitted communications: Ukraine in February 1998, and Lithuania in March 1998.

Q1.2 I understand from Dr. Janet Yellen's testimony and her recent report ("The Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis") that in order for the United States to meet its Kyoto target at "a relatively modest," it will need to rely heavily on emissions trading under the Protocol with such countries as the Ukraine. Please indicate what effect of the emissions of these four Parties, particularly in the case of the Ukraine, will have on the ability of the U.S. to meet its obligations.

A1.2 The CEA analysis does not provide any specific, disaggregated information about these countries. However, estimates regarding the advantage of including the former Soviet Union (FSU, including Ukraine) as well as countries in Eastern Europe in an emissions trading regime are significant. CEA's analysis suggests that their inclusion reduces the cost of permit prices by approximately 72% below costs should the US be required to undertake all emissions reductions domestically. No specific country projections for Ukraine have been prepared.

Obligations of Developing Countries That Are Also OECD Members

Q2. During the June 1998 Bonn meeting of the FCCC Subsidiary Bodies, there were discussions on the issue of Turkey joining the FCCC as a non-Annex I Party. The United States and others seemed to suggest that developing countries that are also OECD members have an obligation to become Annex B members to the Kyoto Protocol and be subject to all of the commitments of the Protocol.

Q2.1 Please identify all developing countries that are OECD members.

A2.1 The following countries are members of the OECD: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. Of these countries, South Korea, and Mexico are not in Annex I of the Convention. Turkey, which is listed in Annex I, has not ratified the Climate Convention.

Q2.2 What are their obligations as OECD members to become Annex B Parties and accept the commitments of Annex B Parties if they want to continue to be OECD members?

A2.2 The participation of a country in OECD does not obligate legally that country, which is a party to the UNFCCC, to assume commitments under the UNFCCC or under Annex B of the Kyoto Protocol. We have sought support of the other Annex I OECD countries for the principle of binding commitments by all OECD countries; most agree.

Q2.3 What, if any, sanctions or enforcement mechanisms can be imposed by the OECD in this regard?

A2.3 OECD does have the delegated authority from its member states to adopt decisions in furtherance of OECD objectives that are binding on its member states. Sanctions or the enforcement mechanism within the OECD, however, has rarely, if ever been imposed to date, to the best of our knowledge. Thus, while they may be technically feasible within OECD, it appears extremely unlikely that OECD sanctions or its enforcement mechanism could be imposed on member states for obligations incurred (or not incurred) under a non-OECD agreement.

Definition of the Term "Meaningful Participation from Key Developing Countries"

Q3. Senator Hagel and I have asked you to define the term "meaningful participation from key developing countries" which has often been used by the Administration before and after Kyoto. It is a phrase that is not found in Senate Resolution 98. Your April 1998 replies to the Senator on this issue were as follows:

> ***"Climate change is a global problem that requires a global solution. Current projections show that developing country emission will surpass those from industrialized countries by 2030 or sooner. The problem of climate change cannot be solved unless developing countries take measures themselves to limit greenhouse gas emissions.***
>
> ***"In determining what developing countries ought to do, we should be aware that the circumstances of developing countries vary widely, along a kind of continuum. Some today are very poor; their greenhouse gas emission are negligible and are likely to remain so for the foreseeable future. Others, whose greenhouse gas emissions are not substantial, are relatively well off. Some are poor on a per capita basis, but their greenhouse gas emissions today rival or surpass those of the advanced industrialized nations. Still others have already joined ranks with the industrialized world in the OECD but have not yet fully accepted the added responsibility for protection of the global environment that comes with their new status.***
>
> ***"We found in Kyoto that even among the industrialized countries it was necessary to recognize the individual national circumstances faced by those differently situated in order to reach agreement, notwithstanding our common purpose. Similarly, any uniform, inflexible approach to the 'meaningful participation of developing countries' is unlikely to prevail."***

* * * *

> *"The term 'developing country' encompasses a wide range of nations which are at various stages of industrialization and contribute differently to global emissions. Accordingly, there is no one-size-fits-all approach to measuring developing country participation. Clearly, a country with per capita high GNP or one that emits a proportionally large share of global emissions should be expected to do more than one that is poor or whose emissions are negligible. China and India, in terms of their contributions to global emissions, the size of their populations and their rates of economic growth, are clearly key countries in the effort to control global greenhouse gas emissions."*

* * * *

> *". . . The Protocol's Clean Development Mechanism will also promote cooperative projects between industrialized and developing countries designed to limit emission in developing countries. And developing countries may take a quantified emission limitations commitments under the protocol's amendment procedure that will enable them to participate in emissions trading with industrialized countries. But these elements alone do not amount to the meaningful participation that the President has called for as a prerequisite for submission of the Protocol to the Senate for approval. More must be done to bring key developing countries more fully into the global response to climate change."*

Q3.1 These replies are both vague and rather non-responsive. On July 16, 1998, the Dow Jones International News Service reported that "South Korea tells Japan it is ready to voluntarily reduce greenhouse gas emissions from 2018, despite not being obliged to do so under an agreement adopted at last December's U.N. Climate Change Conference in Kyoto."

Q3.1.1 Has South Korea informed the State Department that it will adopt new commitments as a developing country and comply fully with the provisions of the Kyoto Protocol?

A3.1.1 No, the Republic of Korea has not so informed the State Department.

Q3.1.2 Is any such commitment including the reported 2018 "base year"—which has not been established—consistent with your definition of the phrase "meaningful participation"?

A3.1.2 No. We have not made any determination with respect to future budget periods or commitments by developing countries.

Q3.1.3 How would South Korea adopt such a commitment?

A3.1.3 It depends upon what is meant by adopting "such a commitment." A State could decide to take certain domestic steps related to climate change, irrespective of any international obligation to do so (for example, by enacting relevant legislation). Alternatively, it could seek to reflect its intended actions in the form of an international obligation. If such an obligation were to be reflected as part of the Kyoto Protocol in particular (as opposed to another international agreement), it could potentially be incorporated in a number of different ways (see answer to 3.1.4 below).

Q3.1.4 Please explain the process by which the Conference of the Parties (COP) and COP serving as a meeting to the Protocol would incorporate this commitment into the Protocol.

A3.1.4 If the Kyoto Protocol were already in force, the COP serving as the meeting to the Protocol (the "COP/MOP") could, pursuant to the amendment procedure set forth in the Protocol, adopt an amendment reflecting a quantitative obligation on the part of a State not currently listed in Annex B. If, as in the example given, the obligation related to a commitment period beyond the first one, it could be incorporated into the same amendment in which the obligations of existing Annex I Parties with respect to future commitments periods will be incorporated.

If it were desired to modify the Kyoto Protocol before it enters into force, the COP could theoretically adopt by consensus a modifying instrument that would have the effect of modifying the Protocol as of its entry into force. However, concerning the particular example given, it is more likely that an obligation relating to a commitment period beyond the first one would be incorporated into the amendment reflecting the obligations of all other Annex I Parties for subsequent commitment periods.

Q3.1.5 What other countries besides South Korea have made similar commitments since December 1997?

A3.1.5 No countries other than those listed in Annex B of the Kyoto Protocol have made commitments to adopt quantified emissions limitation or reduction commitments since December 1997.

Q3.2 Do you agree that countries such as South Korea, Taiwan, Brazil, South Africa, Singapore, Thailand, Mexico, Malaysia, and Indonesia, as well as China and India are "key" developing countries for purposes of the "participation" called for in Senate Resolution 98?

A3.2 Senate Resolution 98 does not differentiate between key developing countries and other developing countries. We agree, however, that the participation of countries such as the Republic of Korea, Brazil, South Africa, Singapore, Thailand, Mexico, Malaysia, Indonesia, China and India—and the example set by them—will be critical in dealing meaningfully with the threat of global warming.

Q3.3 It is my understanding that, at the June 1998 Bonn meeting of the FCCC Subsidiary Bodies, the U.S. delegation was thwarted in its efforts through several avenues to ensure that new emission limitation and reduction commitments for developing countries would be on the agenda for the November meeting of COP-4. In fact, the G-77, and China opposed an agenda item in this regard by the host country, Argentina, and the efforts to link the item to the Turkey issue were not productive. Moreover, on the last day of the Bonn session, the Indonesian delegate, speaking for the G-77 and China, said that "COP-4 should not be distracted by issues which are extraneous to the letter and spirit of the Convention, namely through introductions of any new commitments for the developing country Parties." While I can appreciate that you may be conducting discussions about this issue with China and with other nations, the results, if any, are not evident in the Convention proceedings. What is the Administration's timetable for gaining these commitments as part of the Protocol?

A3.3 Bringing developing countries more fully into the global response to climate change is a complex and difficult task that is complicated by the every different national situations faced by developing countries. We are encouraging all developing countries—particularly newly industrialized and economically advanced developing countries to adopt voluntary commitments to limit the growth in their greenhouse gas emissions in the first budget period (2008-12). At the same time, developing countries should also be encouraged to take meaningful actions now to improve energy efficiency, switch to fuels that produce fewer greenhouse gases, increase the percentage of renewable forms of energy production in their national fuel mix, slow deforestation, preserve and protect greenhouse gas sinks and reservoirs, etc. In addition, developing countries in a position to do so should be encouraged to support the efforts of less fortunate countries to respond to global warming.

Changing the Protocol by Decisions of any Subsidiary Body or the COP

Q4. At the June 1998 Bonn meeting of the FCCC Subsidiary Bodies, the Subsidiary Body for Scientific and Technology Advice (SBSTA) adopted the following conclusion (paragraph 2 of document FCCC/SBSTA/1998/CRP.3):

> *"It [SBSTA] understands the meaning of Article 3.3 in the Kyoto Protocol to be as follows: The adjustment to a Party's assigned amount shall be equal to verifiable changes in carbon stocks during the period 2008 to 2012 resulting from direct human-induced activities of afforestation, reforestation and deforestation since 1 January 1990. Where the result of this calculation is a net sink, this value shall be added to the Party's assigned amount. Where the result of this calculation is a net emission, this value shall be subtracted from the Party's assigned amount."* **[emphasis supplied]**

Article 3.3 of the Kyoto Protocol states:

> *"The net changes in greenhouse gas emission by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex 1. The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8."* **[emphasis supplied]**

Q4.1 It appears that SBSTA, apparently with the support of the U.S. delegation, is attempting to change the Protocol by "conclusion." I also note that it is my understanding that despite clear instructions to the contrary by the Senate to your Department, the Parties to the COP adopted a "no reservation" clause in Article 26, which would apparently preclude the Senate from adopting reservations as a condition of advice and consent to ratification (see "Treaties and Other International Agreements: The Role of the United States Senate," A Study prepared for the Committee on Foreign Relations, United States Senate by the Congressional Research Service, Library of Congress, November 1993, S. Prt 103-53, page xxix). However, in this action by SBSTA, the Parties have apparently concluded that they may change the Protocol to their liking even before any country ratifies it, by this informal, non-binding process, rather than by amendment pursuant to Article 20.

Q4.1.1 Please identify the provision in the Protocol that authorizes such changes by conclusion or decision by any Subsidiary Body or the COP.

A4.1.1 The SBSTA document you refer to does not represent a binding decision. First, Article 3.3 does not authorize an interpretative decision. Second, in no event would SBSTA as opposed to the COP or COP/MOP, whichever were authorized) have the authority to take such a decision.

Q4.1.2 I note that some Articles of the Protocol call for guidelines, rules, etc., while others (e.g., Article 3.3) do not. Do the Parties have authority in the Protocol to adopt guidelines, rules, modalities interpretations for provision or Articles that do not specifically authorize guidelines, rules, etc., and if so, please explain the basis for that view and indicate which body under the Convention or Protocol has this authority?

A4.1.2 You correctly note that some Articles of the Protocol expressly call for further decisions on rules, etc. to be taken, while others do not. In the case where a Protocol provision expressly mandates or authorizes a further decision, it depends upon the context of the provision whether such a decision would be legally binding. However, in the case where such a decision is not expressly mandated or authorized, there is no question that any decision taken by Parties in that regard would not be legally binding.

Q4.1.3 Must the SUBSTA decision to change the term "since 1990" to "since January 1, 1990" be adopted by decision of the FCCC Conference of the Parties (COP) to be valid? Can that be done before the Protocol enters into force?

A4.1.3 It is unclear what your questions intends by the term "valid." As noted in the response to question 4.1.1 above, Article 3.3 does not authorize a binding decision, even *if such* a decision *were* taken by the *COP* serving as the meeting of the Parties to the Protocol ("COP/MOP"). Thus, even if the SBSTA document were later approved by the COP/MOP, it would not be binding upon Parties.

Q4.2 When and if the Kyoto Protocol is submitted to the Senate for advice and consent to ratification, will the Senate be considering the Protocol as adopted on December 11, 1997 or with such subsequent changes, and how will the Senate be made aware of such changes?

A4.2 If any changes were taken that would be binding upon Parties, the Senate certainly would be made aware of such decisions for purposes of its consideration of the Protocol.

Q4.3 Is the SBSTA setting a precedent to be followed for other provisions in the Protocol, such as the term "by 2005" in Article 3.2, and the word "supplemental" in Article 17, that some might want to "clarify" through this mechanism?

A4.3 No, the SBSTA is not setting a precedent for other provisions:

— As a threshold matter, for the reasons noted above in the response to 4.1.1, the SBSTA document does not represent a binding decision.

— Specifically regarding the term "by 2005," this term is not amenable to a binding decision by the COP or COP/MOP. In any event, the term, which uses the word "by" (as opposed to "since") and appears in a different context, would to be interpreted on is own merits.

— Specifically regarding the term "supplemental," this term is also not amenable to a binding decision by the COP or COP/MOP. Although the COP is expressly authorized to define the relevant principles, modalities, rules and guidelines for emissions trading, it is clear from the provisions (including its negotiating history) that the COP is not authorized to further define (or quantify) the term "supplemental."

Q4.4 What are the consequences for the U.S. of this change?

A4.4 The change referred to interprets the text "since 1990" of Article 3.3 to be considered inclusive of the year 1990—that is, beginning January 1, 1990 and not on December 31, 1990. The United States supported this interpretation for two principal reasons.

(1) It helped assure a more robust data base (recognizing the reality that many countries have good data for 1990 activities, but may not have recorded equally good data in 1991; and

(2) it allowed the United States to count afforestation, reforestation and deforestation activities implemented in 1990 to count against our budget period commitment (noting that these actions total several million metric tons of emissions offsets).

The net benefits identified were considered significant both to the United States and to the overall system, and were supported by the United States in Bonn.

Q4.5 **What analysis did the U.S. perform prior to Bonn to assure itself that this change is in the best economic and environmental interests of the U.S.? Please provide that analysis.**

A4.5 The analysis was simple: the U.S. delegation was aware that the activities described in Article 3. Contributed to a net decrease in CO_2 emissions; thus we sought to have these actions counted against the U.S. commitment. A more accurate global accounting of net emissions and reduced cost to the United States resulted from this position. No further analysis was considered necessary to adopt this position.

Workshops/IPCC Special Report on Land-Use Change and Forestry

Q5. **In addition, SBSTA made the following requests:**

> *"The SBSTA requested the secretariat to organize a workshop prior to the fourth session of the Conference of the Parties (COP 4) with participation by experts including those nominated by the Intergovernmental Panel on Climate Change (IPCC), possibly coincident with an IPCC expert meeting. The purpose of the workshop will be to consider data availability based on definitions used by Parties and international organizations, including their implications, in relation to Article 3.3 and to consider any further inputs to the IPCC, including to the report referred to in paragraph 5 below. It also agreed to plan a second workshop after COP 4 to focus on issues arising from Article 3.4 and document FCCC/SBSTA/1998/INF.1, the comments submitted by Parties and issues arising from the first workshop. It requested the secretariat to report on the initial workshop at the ninth session of the SBSTA."* **(paragraph 4 of document FCCC/SBSTA/1998/ CRP.3)**

> *"The SBSTA requested the IPCC to prepare and provide information to the SBSTA and the COP, in particular a special report as defined by IPCC procedures, on land-use, land-use change and forestry, in order to enable the COP to take decision on land-use change and forestry, in order to enable the COP to take decisions on recommendations on these issues to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its first session. The special report should address the methodological, scientific and technical implications of the relevant articles of the Protocol, particularly Article 3. The special report should consider the anthropogenic implications of full carbon stock accounting, set the overall scientific context for consideration of land-use, land-use change and forestry activities, and consider the initial list of scientific and technical questions contained in FCCC/SBSTA/1998/INF.1 and comments provided by the Parties to the secretariat by 15 August 1998."* **(paragraph 5 of document FCCC/SBSTA/1998/CRP.3)**

Q5.1 I understand that the U.S. supported the need for these workshops and was even willing to fund all or part of them. Please explain:

Q5.1.1 Why these workshops are needed and desirable for U.S. purposes.

A5.1.1 It was clear from the discussion in Bonn that different members of the international community held different views on the interpretation of Article 3.3 In order to achieve a more transparent and common understanding of how the land use change and forestry provisions of the Protocol are to be implemented, it was considered necessary to come to a common understanding of the language—and the best way to such common views was thought to be through a series of technical and policy relevant workshops.

Q5.1.2 When they are scheduled.

A5.1.2 To date, only the first of the workshops has been scheduled; it was held in Rome (headquarters of the Food and Agriculture Organization, FAO, which hosted the workshop) from September 23-25, 1998. We anticipate a second workshop in January or February 1999; Atlanta, Georgia is being reviewed as a possible venue.

Q5.1.3 What effort will be made in the U.S. to ensure broad participation by interested persons in the private sector.

A5.1.3 The Administration has widely solicited names of technical experts to participate in the technical portions of the workshop—nominating individuals with academic, environmental organizational, and private sector backgrounds to participate, as well as those from within the government. We have also held consultations on the issues of land use change and forestry with members of the forest and forest products industries, seeking to fully understand both their concerns, and possible proposals to address those concerns. Finally, the Subsidiary Body for Scientific and Technical Advice, which is co-sponsoring the meeting with the IPCC, is open to all accredited observer organizations to the FCCC. Members of the private sector are this able to attend the workshop as observers as long as they register appropriately.

Q5.1.4 The estimated costs to conduct these workshops and the extent of U.S. funding.

A5.1.4 We do not have an estimate of the cost to hold the workshop. However, we do know that much of the meeting cost was borne by the FAO, while the participation of experts (particularly from developed countries) was supported by nominating governments. We have requested additional detail on actual meeting costs from the FCCC Secretariat. The United States has offered to host the second workshop; we anticipate a meeting cost of approximately $50,000 to support this session.

Q5.2 Please identify and provide the relevant "definitions used by Parties and international organizations." Have the definitions of "afforestation, reforestation and deforestation" been defined in the U.S.? If not, why not, and if so, please provide them.

A5.2 Attached is a paper prepared by USDA's Forest Service that has examined the international literature on forestry related definitions. As can be seen, a wide variety of interpretations exists for each term. The Administration has not taken a decision on which definitions should be used for purposes of the FCCC process; we are currently engaged in a process to evaluate the alternatives, and to determine which would be the most appropriate. *[Note: This paper is contained in document FCCC/CP/1998/MISC.1, pp. 59-78.]*

DEFINITIONS OF DEFORESTATION, AFFORESTATION, AND REFORESTATION

A report prepared for the USDA Forest Service and IUFRO 6.03.02

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Abstract: The Third Conference of the Parties to the United Nations Framework Convention on Climate Change (FCCC) held 1-11 December 1997 in Kyoto, Japan calls for, among other things, the tracking emission sinks resulting "from direct human-induced land use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990." The FCCC Secretariat called for clarification of the use of these terms as they are used in various parts of the world [see: http://www.unfccc.de, Official Documents, Subsidiary Body for Scientific and Technological Advice (SBSTA) Document FCCC/SBSTA/1998/INF.1].

We initially developed this paper at the request of Dr. H. Fred Kaiser, USDA Forest Service. It has since been updated to incorporate input from the IUFRO Working Unite 6.03.02 Discussion Group on Reforestation, Afforestation, and Deforestation (RAD). This paper lists various definitions that have been used or are in use for deforestation, afforestation, and reforestation. To have a clear understanding of these terms we also need to definitions of tree, forest, degradation and other terms. The definitions we present were derived from a search via the Internet and from individual input. We list the sources used and additional contacts at the end of this paper. We also present a short discussion and comparison at the end of each set of definitions. See also http://home.att.net/~gklund/RADQA.html

Our thanks to all those that responded to our emails and provided the most valuable input.

Keywords: Climate change, forest, tree, afforestation, deforestation, reforestation, plantations.

GENERAL DISCUSSION

Deforestation, afforestation, and reforestation are actions or acts. There are probably fewer disagreements over these terms than on what to call the lands (deforested, afforested, and reforested) once the action is completed and how long the lands remain in those historical categories.

The decision on which terms and definitions presented here must be considered in light with the end point in mind. Most importantly, we need a clear understanding of what it is that we are interested in and how we wish to use the information. It may turn out that none of the terms listed below are what is needed.

There are several issues one must consider. The Kyoto protocol speaks of changes in *human-induced land use changes* Are natural tree invasions, in the case of afforestation, and natural regeneration, in the case of reforestation, acknowledged or accepted? Do the terms reforestation and afforestation imply that there will be timber crops produced or just tree cover increased? Did the authors really mean **land use** or did they mean **land cover**?

Land Cover

4. **That which overlays or currently covers the ground, especially vegetation, permanent snow and ice fields, water bodies, or structures. Barren land is also considered a 'land cover' although technically it is lack of cover. The term land cover can be thought of as applying to the setting in which action (one or more different land uses) takes place. [Source: Interim Resource Inventory Glossary. U.S. Dept. of Agriculture, Forest Service. 14 June 1989]**
2. **The observed (bio) physical cover on the earth's surface. Also aspects describing land itself rather than land cover have been included (e.g. bare areas, waterbodies, etc.) because in practice the scientific community is used to describe those aspects under the term land cover [Source: Di Gregorio and Jansen 1997, 1998, Jansen and Di Gregorio 1998].**

Land Use

1. **The predominant purpose for which an area is employed. [Source: Interim Resource Inventory Glossary. U.S. Dept. of Agriculture, Forest Service. 14 June 1989]**
2. **The arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it. [Source: Di Gregorio and Jansen 1997, 1998, Jansen and Di Gregorio 1998]. A given land use may take place on one, or more than one, piece of land and several land uses may occur on the same piece of land. Definition of land use in this way provides a basis for precise and quantitative economic and environmental impact analysis and permits precise distinctions between land uses, if required. Lands may be devoid of forest cover, but may be used for forestry purposes. Similarly, lands may have tree cover, but not used for forestry use – i.e. "urban forests."**

If one is speaking of carbon sequestration, the fact that some lands with trees are considered forests and others are considered agricultural lands is unimportant. Rather than getting embroiled with definitions of forests, etc., we may prefer to speak of vegetated, revegetated, and devegetated lands where woody vegetation is the primary interest. Thus, one would include all lands with trees on them (forests, agricultural lands, urban areas, etc) and the changes in that cover.

What is important is the kind, amount (extent and size), and relative permanence of the woody vegetation. The kind and amount can be determined from remote sensing. The relative permanency depends, in part, on the landowners' management objectives.

To determine if an area has been afforested, deforested, or degraded, or vegetated (*having established vegetation in or on* – WWWebster), *revegetated (having provided barren or denuded lands with a new vegetative cover* – WWWebster) or devegetated (*having removed the vegetation from an area*), one must have some indication of what was the prior land and vegetation condition. The location and degree of change is determined by **monitoring** changes in land and vegetation cover. The interpretation depends on the **time interval** between observing or reporting periods. For example if an area was clearcut in 1996 and planted in 1997 – one could say the area was deforested in 1997 and reforested in 1998. If the same area were observed again in 1999, is the area now considered forested, reforested, or both? The fact that such estimates are estimates of change and with the estimates of change, the time factor is of importance is often overlooked.

The area of forested land may be easily determined from national inventories or remote sensing projects. If the inventories involve permanent sample sites or if periodic remote sensing coverage is obtained, one can determine which areas have changes in vegetation cover. Again, monitoring is an essential if one is to determine areas of forest degradation, deforestation, reforestation, and afforestation. The results from national forest inventory program which do not have monitoring components should be questioned.

Note from Christoph Kleinn: I think, the only easy thing is to copy the numbers from the results volume. Technically, as you know, there are various uncertainties around those data. Lastly, most forest inventories, do not look at lands where there are no trees. Consequently statistics on areas suitable for reforestation and afforestation will probably be missing nationally and globally.

TREE

1. A woody perennial with a single main stem or, in the case of coppice, with several stems, having a more or less definite crown. Includes: Bamboos, palms another woody plants meeting the above criterion. [Source: UN-ECE/FAO Temperate and Boreal Forest Resource Assessment 2000 – Terms and Definitions. GE.97-22231. 1997. 13 p.]
2. Woody plants that generally have a single main stem and have more or less definite crowns. In instances where life form cannot be determined, woody plants equal to or greater than 5 m in height will be considered trees. [Source: http://biology.usgs.gov/fgdc.veg/standards/appendix3.htm]
3. A woody plant usually having one or more perennial stem at least 3 inches d.b.h. at maturity, a more or less definitely formed crown of foliage, and a height of at least 16 feet at maturity. [Source: USDA Forest Service. 1989. **INTERIM RESOURCE INVENTORY GLOSSARY**. Document dated June 14, 1989. File 1900.Washington, DC: U.S. Department of Agriculture, Forest Service. 96 p]
4. A woody perennial plant having a single usually elongate main stem generally with few or no branches on its lower part [Source: WWWebster]

Discussion: Definitions two and three have a built-in height threshold.

FORESTRY

The science of developing, caring for, or cultivating forests b : the management of growing timber (WWWebster)FORESTS

1. Ecological systems with a minimum of 10% crown coverage of trees and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subject to agricultural practices. [Source: from http://faov02.fao.org:70/0gopher_root%3a[fao.fra]def_uk.txt (concepts, definitions and methodology of the FAO Forest Resources Assessment 1990) via Bernhard Schlamadinger]
2. A land area with a minimum 10 % tree crown coverage (or equivalent stocking level), or formerly having such tree cover and that is being naturally or artificially regenerated or that is being afforested. [Source: Päivinen et al. Via Brita Pajari]
3 Forest and other wooded land . Land under natural or planted stands of trees, whether productive or not and exceeding 0.5 ha in extent. It includes areas occupied by roads, small cleared tracts and other small open areas within the forest which constitute an integral part of the forest. [Source: Päivinen et al. Via Brita Pajari]
4 (UN-ECE/FAO) Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 m at maturity in situ. May consist either of closed forest formations where trees of various storeys and undergrowth cover a high portion of the ground; or of open forest formations with a continuous vegetation cover in which tree cover exceeds 10 percent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 percent or tree height of 5 m are included under forest, as are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest. Includes: Forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracts, firebreaks, and other small open areas within the forest; forest in national parks, nature reserves and other protected areas such as those of special environmental, scientific, historical, cultural, or spiritual interest; windbreaks and shetlterbelts of trees with an area of more than 0.5 ha and a width of more than 20 m. Rubberwood plantations and cork oak stands are included. Excludes: Land predominantly used for agricultural practices. [Source: UN-ECE/FAO 1997]
5. Canada - BC) Crown land or private land that is predominantly maintained in one or more successive stands of trees, successive crops of forage, or wilderness. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
6. (Ukraine) Combination of land, vegetation dominated by trees and shrubs, animals, microorganisms and other natural components interconnected in their development and influencing each other and the environment." [From: ``The Forest Code of Ukraine" Kiev, 1994, 56p. "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]
7. (developed countries) Land with tree crown cover (stand density) of more than about 20 per cent of the area. Continuous forest with trees usually growing to more than about 7 m in height and able to produce wood. This includes both closed forest formations where trees of various storeys and undergrowth cover a high proportion of

the ground, and open forest formations with a continuous grass layer in which tree synusia cover at least 10 per cent of the ground. [Sources: "State of the World's Forests", FAO, 1997, pp. 173-174; Schuck, A., Parviainen, J. and Bücking, W. 1994. A review of approaches to forestry research on structure, succession and biodiversity of undisturbed and semi-natural forests and woodlands in Europe. EFI Working paper 3. Draft 15.8.1994. 62 pp.; Silviculture Terminology - Introduction, Silviculture Terminology - September 1993. SAF Silviculture Working Group Newsletter (D-2). October 1993. Society of American Foresters. Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

7. Land under natural or planted stand of trees, whether productive or not. Included are shrub land, savannah etc., land from which forests have been cleared but that will be reforested in the foreseeable future, area occupied by forest roads, small cleared tracts and other small open areas within the forest and which constitute an integral part of the forest. [Sources: FAO yearbook Production. 1992. Vol. 46. FAO Statistics Series No. 112. 281 pp. ; Schuck, A., Parviainen, J. and Bücking, W. 1994. A review of approaches to forestry research on structure, succession and biodiversity of undisturbed and semi-natural forests and woodlands in Europe. EFI Working paper 3. Draft 15.8.1994. 62 pp.; Silviculture Terminology - Introduction, Silviculture Terminology - September 1993. SAF Silviculture Working Group Newsletter (D-2). October 1993. Society of American Foresters. Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]
9. (USA - Massachusets) Land that is at least sixteen and seven-tenths per cent stocked, that contains at least seven and five-tenths square feet of basal area per acre by forest trees of any size; or that formerly had such tree cover and is not currently developed for non-forest use; or that is a plantation containing at least five hundred trees per acre. [Source Chapter 61 Massachusets Taxation Law - http://www.forestmeister.com/laws/ch61.html]
10. (Sweden) Land which is suitable for wood production, and not used to a significant extent for other purposes; and land where tree cover is desirable in order to protect against sand or soil erosion, or to prevent a lowering of the tree line. [Source: Swedish Forest Act - http://www.svo.se/eng/englaw.htm]
11. (Russia) One of main types of vegetation consist of an aggregate of trees, shrub, grassy etc. plants (mosses, lichens), including animals and microorganisms biologically interconnected in the development and influencing against each other and an environment. [From: " Russian Forest Encyclopedia" "Igor Yakovlev" yakovlev@mari-el.ru Date: Sat, 6 Jun 1998 21:16:59 +0400]
12. (Russia) A population of forest plants changed in the exterior form and an internal structure under influence of effect against each other, on occupied soil and atmosphere. (G.F. Morozov- archfounder of scientific forestry in Russia). In practice of forestry forest consider as tree stands with a polnota more than 0,3. If polnota less than 0,3 - stand calls as light forest or open woodland. Main difference of a forest from "not forests " - the existence of mutual influence between all elementary component of a forest. [From: " Russian Forest Encyclopedia" "Igor Yakovlev" yakovlev@mari-el.ru Date: Sat, 6 Jun 1998 21:16:59 +0400]
13. (Slovenia) A plot of land overgrown with forest trees in the form of stands or other forest growths which provide any of the functions of a forest. Forests according to this

law also include overgrown plots of land defined as forest in the spatial element of the forest management plan. The following are not forest within the meaning of this law: individual forest trees, groups of forest trees up to an area of five hectares, non-autochthonous riverine and windbelt trees, avenues, parks, plantations of forest trees, pens for rearing game, and pastures overgrown with forest trees if used for pasturing, irrespective of how they are described in the land register. [From: Slovenian LAW ON FORESTS - Milan SINKO milan.sinko@UNI-LJ.SI via "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Fri, 12 Jun 1998 16:11:17 +0300 (MSD)]

13. (Czech Republic) Forest stands with its environment and land designated for the fulfillment of forest functions. Forest functions shall mean benefits towards the general well-being of the society conditional on the existence of forests, which consist of wood-producing and non-wood-producing functions. Forest stands shall mean trees and shrubs of forest tree species which, in their particular environment, fulfil forest functions. [Source: Act on Forests and Amendments to Some Acts (the Forest Act) dated 3 November 1995. Ministry of Agriculture of the Czech Republic. Prague, 1996. 58 pp. From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 11:32:47 +0300 (MSD)]

15. (Norway) Land which produces forest or which on an overall farming- and forestry assessment is considered to be most suitable for forest production and is not being used for any other purpose. [Source: The Norwegian Forest and Forest Protection Act of May 21, 1965 with amendments, latest by the Act no. 96 of June 11, 1993. http://www.nijos.no/panorama/!skog.htm From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 19:27:19 +0300 (MSD)]

16. (USA) Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearing and powerline clearing of any width. [Source: Code of Federal Regulations. Title 36, Volume 2, Parts 200 to 299. [Revised as of July 1, 1997. CHAPTER II--FOREST SERVICE, DEPARTMENT OF AGRICULTURE. PART 219--PLANNING. Subpart A--National Forest System Land and Resource Management Planning. Sec. 219.3 Definitions and terminology. http://www.fs.fed.us/outdoors/wildlife/wfrp/plans/cfr219.txt From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Sat, 27 Jun 1998 16:14:46 +0300 (MSD)] The land must be a minimum of one acre in area. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land; and unimproved roads, trails, streams, and clearings within forest areas are classified as forest land if they are less than 120 feet wide. [Source: FSH 4809.11 Forest Survey Handbook, 1972. USDA Forest Service, Washington, DC]

17. (and Woodland). Land under natural or planted stands of trees, whether productive or not. This category included land from which trees have been cleared but will be reforested in the foreseeable future, but it excludes woodland or forest used only for recreation purposes. Stands of permanent crops such as rubber, fruit trees, nut trees, are classed as permanent crops under agricultural lands. [Source: FAO Production Yearbook. 10.10.97. http://www.fao.org/waicent/faosat/agricult/landuse-e.htm]

18. Assemblages of ecosystems comprised of trees, other vegetation, litter and soils, each having its own temporal dynamics, carbon storage patterns, and carbon release rates to the atmosphere. [Source: FCCC/SBSTA/1998/INF.1, 18 May 1998]
19. (developing countries). Ecosystem with a minimum of 10 per cent crown cover of trees and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subject to agricultural practices. [Source: "State of the World's Forests", FAO, 1997, pp. 173-174].
20. An area of tree-covered land typically consisting of hundreds or thousands (or more) of individual stands comprising trees of similar species composition, age-structure and management regime. [Source: Glossary in M.J. Apps and D.T. Price (eds.) (1996). *Forest Ecosystems, Forest Management and the Global Carbon Cycle.* NATO ASI Series I (Global Environmental Change), vol. I 40, Springer-Verlag Academic publishers, Heidelberg.]
21. A dense growth of trees and underbrush covering a large tract [Source: WWWebster Dictionary]
22. (India) Any land recorded as forest in any of the land records is legally a forest land. This legal connotation provides a working definition of forest land to the forest managers in India for all the practical purposes. This definition disregards whether there is any vegetation on that land or not. [Source: Forest Conservation Act, 1980, From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]
23. (Kyoto forest) That part of forests in industrialized countries whose changes in carbon stocks during the commitment period are used to meet emission reduction commitments. Under Article 3 para 3 of the Kyoto Protocol, these are such forests that are affected by afforestation, reforestation and deforestation that has taken place since 1990, and for which verifiable changes in carbon stocks attributable to these activities are measurable in the first commitment period (2008-2012).

Discussion: The definitions of "forest" and "forest land" vary considerably from being an administrative unit (Def. 14 and 22. See also Forest Fund below), a function of land use (Def. 2, 8, 9, 14, 15, 16), and one of tree cover (Def. 1, 3, 4, 7, 11, 12, 13, 20, 21) or combinations thereof (Def. 4). Definition one is an old FAO one used for the tropics in the 1990 Global Forest Resources Assessment. The definition for the developed world used a 20% crown cover threshold. Definition 4 is now the "official" FAO definition for the 2000 Global Forest Resources Assessment. As you will note it is based upon a combination of tree cover, land potential, and land use with land use or potential dominating. Definition 23 restricts "forests" to industrialized countries.

FORESTATION

1. (North Amer.) (Afforestation, Reforestation) The establishment of forest, naturally or artificially, on an area, whether previously carrying forest or not. [Source: Ford-Robertson via Tim Mullen]
2. (Chile) La acción de poblar con especies arbóreas o arbustivas terrenos que carezcan de ellas o que estando cubiertos de vegetación, ésta no sea susceptible de explotación económica, ni mejoramiento mediante manejo. [Source: Chile Forest Law 701 via Juan Pablo Cerda]

AFFORESTATION

1. The act or process of establishing a forest especially on land not previously forested. [Source: WWWebster Dictionary]
2. (USA) Establishment of forest crops by artificial methods, such as planting or sowing on land where trees have never grown. [Source: Timber Harvesting and Engineering Glossary, USFS]
3. The artificial establishment of forest corps by planting or sowing on land that has not previously, or recently, grown trees. [Source: Water Words Dictionary]
4. The establishment of a tree crop on an area from which it has always or very long been absent. NOTE: Where such establishment fails and is repeated, the latter may properly be termed reafforestation. [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen and Silvicultural Terms in Canada - Second Edition 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]
5. (Australia and New Zealand) The establishment of a species of forest on an area where it does not occur naturally (British Commonwealth Terminology). [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
6. The establishment of a forest or stand of trees by sowing, planting, or natural regeneration on an area not previously forested, or in areas where forests were cleared long ago and other land-use patterns have dominated the landscape for many generations (e.g., the moorlands of Great Britain). [Source: J. Dunster and K Dunster via Eric Boa, Phil Loseth and Renate Prüller]
7. [The establishment of plantations] to produce a forest product "crop" on lands that previously have not supported forests for more than 50 years. [Source: From IPCC Guidelines, Reference Manual, p. 5.13 (Brown et al., 1986: Brown S., A.E. Lugo and J. Chapman (1986), Biomass of tropical tree plantations and its implications for the global carbon budget", Canadian Journal of Forest Research 16: 390-394). via Bernhard Schlamadinger]
8. The establishment of a tree crop on an area from which it has always or very long been absent. Where such establishment fails and is repeated, the latter may properly be termed reafforestation. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger].
9. (Canada - BC) The establishment of trees on an area that has lacked forest cover for a very long time or has never been forested. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
9. The establishment of forest on a previously non-forested site. [Source: Definition prepared for a still unpublished work on forest management via Renate Prüller]
11. Artificial establishment by planting or seeding of forest on a non-forest area (e.g. agricultural or other land). [Source: UN/ECE 1990, via Brita Pajari]
12. Planting of new forests on lands which, historically, have not contained forests. These newly created forests are included in the category Changes in Forest and Other Woody Biomass Stocks in the Land Use Change and Forestry module of the emissions inventory calculations. [Source: IPC Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Reporting Instructions (vol. I), Glossary, pp. 1-18]

13. (Ukraine) Creation of forest plantation on the lands which previously were not covered by forest. Note that ``forest plantations" defined as ``forest stands created by planting of seedlings, saplings of trees or shrubs or by sowing of their seeds", i.e. it here this means only origination of stands, not intensity of management. . [Source: State Standard of Ukraine, DSTU 2980-95 ``Forest plantations. Terms and definitions", being in force since 01.01.96. From: "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Sat, 28 Mar 1998 21:09:08 +0200 (UKR)]
14. Establishing new forests on lands which have not contained forests before. [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
15. Establishing new forests on lands which, historically, have not contained forests. [From: Schlamadinger Bernhard uvu@ornl.gov Date: Tue, 9 Jun 1998 18:02:09 -0400 (EDT)]
16. (Czech Republic) Creation of forest plantation on the lands which previously were not covered by forest. The establishment of forest stand. [Source: Act on Forests and Amendments to Some Acts (the Forest Act) dated 3 November 1995. Ministry of Agriculture of the Czech Republic. Prague, 1996. 58 pp. From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 11:32:47 +0300 (MSD)]
17. (India) Defined as bringing any land under forest cover, which was not previously under forest cover. [Source: Glossary of Technical Terms, Forest Research Institute, India. From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]

Discussion: Definitions 2, 4, 7, and 8 use the term "crop" in the definition. If taken literally, this implies that the trees are planted for commercial uses. Shelterbelts, plantations for carbon sequestration may not be included. Definition 5 approaches an issue of planting exotic species. Definitions 2, 3, 11, 12,13 and 16 allow only artificial establishment. The rest permit natural establishment such as Pinyon-Juniper invading lands that previously did not have tree cover. Definition 12 does not mention sowing. Definition 16 does not specify if the land was not previously forested. See definition of ***plantation*** below.

REFORESTATION

1. The act of renewing forest cover by planting seeds or young trees. [Source: WWWebster Dictionary]
2. Restocking an area with forest trees. [Source: Timber Harvesting and Engineering Glossary, USFS]
3. The planting of trees on land from which the forest has been removed. [Source: Water Words Dictionary]
4. (Reforestation is a preferred synonym) forestation, revegetation (meaning the key term is narrower in sense than the one following). [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
5. Re-establishment of a tree crop on forest land (British Commonwealth Terminology). [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
6. The natural or artificial restocking of an area with forest trees. Typically, refers to planting. [Source: J. Dunster and K Dunster via Eric Boa and Renate Prüller]

7. Establishment of a tree crop on forest land. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger]
8. [The establishment of plantations] to produce a forest product "crop" on lands that have supported forests within the last 50 years and where the original crop has been replaced with a different one. [Source: From IPCC Guidelines, Reference Manual, p. 5.13. (Brown et al., 1986: Brown S., A.E. Lugo and J. Chapman (1986), Biomass of tropical tree plantations and its implications for the global carbon budget", Canadian Journal of Forest Research 16: 390-394). via Bernhard Schlamadinger]
9. (Canada - BC) The natural or artificial restocking (i.e., planting, seeding) of an area with forest trees. Also called forest regeneration. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
10. The restocking of felled or otherwise cleared woodland. [Source: British Commonwealth Forest Terminology via Renate Prüller]
11. (Chile) La acción de poblar con especies arbóreas o arbustivas mediante plantación, regeneración manejada o siembra, un terreno que haya sido objeto de explotación extractiva. [Source: Chile Forest Law 701 via Juan Pablo Cerda]
12. Artificial (planting, seeding) or natural re-establishment of forest on previously forest or other wooded land. [Source: UN/ECE 1990, via Brita Pajari]
13. Planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use. Replanted forests are included in the category "Changes in Forest and Other Woody Biomass Stocks" in the Land Use Change and Forestry module of the emissions inventory calculations. See also Afforestation. [Source: IPC 1995. Via Gregg Marland]
13. (Ukraine) (Artificial) reforestation -- creation of forest plantations on the lands which were not previously under forest (covered by forest)with the aim of formation economically valuable, high productive and biologically sustainable forest stands. Note that ``forest plantations" defined as ``forest stands created by planting of seedlings, saplings of trees or shrubs or by sowing of their seeds", i.e. it here this means only origination of stands, not intensity of management. [Source: Polyakov]
15. Establishing forests on lands which have, historically, previously contained forests but which have been converted to some other use. This "other use" must have prevailed for at least 20 (or other number to be chosen) years, or, alternatively, the "other use" can be shorter if the land has been counted as "deforested" within a commitment period under the Kyoto Protocol. [From: Schlamadinger Bernhard uvu@ornl.gov Date: Tue, 9 Jun 1998 18:02:09 -0400 (EDT)]
16. (Russia) Process of establishing of forest cultures on before forested areas. (Forest cultures (specific Russian term) - forest, which was created by seeding or planting). [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
17. (Canada - Sask.) The natural or artificial restocking of an area with trees. [Source: Chapter F-19.1: An Act Respecting the Management of Forest Resources... new provincial legislation on forest management From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]
18. (Canada - Sask.) [reboisement (n.m.)] syn. reafforestation - Successful renewal of a forest crop by planting or direct seeding. [Source: Silvicultural Terms in Canada -

Second Edition 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]

19. (IPCC) Planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use. Replanted forests are included in the category, Changes in Forest and Other Woody Biomass Stocks, in the LUCF module of the emissions inventory calculations. [Source: IPCC. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Reporting Instructions (vol. I), Glossary, pp. 1-18]
20. (India) Bringing any deforested land under forest cover. [Source: Glossary of Technical Terms, Forest Research Institute, India. From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]

Discussion: Definitions 1, 2, 6, 8, 9 and 14 call for the planting of "forest" trees. Definitions 5; 7, 8 and 18 imply the trees will be used as a crop. Thus at some point in time, they will be removed for commercial purposes. Definitions 1, 2, 13, 14 and 19 imply only artificial regeneration and only through planting. Definition 13 implies that the land being replanted is not currently being used as "forest." Definitions 5,7 8, and 14 imply trees are planted for economic return. Definition 14 also sounds more like afforestation than reforestation. Definitions 17 and 20 allow for any means of establishing tree cover on areas previously forested. See definition of ***plantation*** below.

NATURAL FOREST

1. Growing without human care; also : not cultivated <natural prairie unbroken by the plow. Existing in or produced by nature. Not artificial. [Source WWWebster 11 June 1998]
2. A forest which has evolved as a sequence of natural succession but is still showing anthropogenic influences. Also, forests that have developed from unmanaged pastures or from fallow land. Often natural parks are included in this category. [Source: Dudley, N. 1992. Forests in trouble. A Review of the status of temperate forests worldwide. WWF. 260 pp. . Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

Discussion: Definition one does not allow human care where definition two allows some influence.

DEGRADATION

1. Changes within the forest class which negatively affect the stand or site and, in particular, lower the production capacity. Thus degradation is not reflected in the estimates of deforestation. [Source: from http://faov02.fao.org:70/0gopher_root%3a[fao.fra]def_uk.txt (concepts, definitions and methodology of the FAO Forest Resources Assessment 1990) via Bernhard Schlamadinger]
2. (Canada - BC) The diminution of biological productivity or diversity. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
2. (Slovenia) Forest in which the growth rate, or the fertility of forest land, is reduced, or other possibilities for it to perform its function as a forest are reduced by negative

outside influences. [From: Slovenian LAW ON FORESTS - Milan SINKO milan.sinko@UNI-LJ.SI via "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Fri, 12 Jun 1998 16:11:17 +0300 (MSD)]

4. Changes within the forest class, for example, from closed to open forest, which negatively affect the stand or site and, in particular, lower the production capacity. These lands are considered apart from deforestation. [Source: "State of the World's Forests", FAO, 1997, pp. 173-174]
3. The act or process of degrading (lowering to an inferior level) [Source: WWWebster Dictionary].

Discussion: All five definitions imply a reduction in productivity. Question: If one reports on degraded forest land, shouldn't there be a reciprocal category of improved forest land where production has been increased?

DEFORESTATION

1. The action or process of clearing of forests. The state of having been cleared of forest. [Source: WWWebster Dictionary]
2. (Deforest) To clear an area, other than purely temporarily, of forest. 1) While man is the main deforester, natural agencies (e.g. volcanic eruption, landslides) may also contribute. (2) Clear cutting (even with stump removal), if shortly followed by reforestation is not deforesting. [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
3. The long-term removal of trees from forested site to permit other site uses. Cutting of trees followed by regeneration is not deforestation. syn: forest clearing disturbance, conversion, or wasteful destruction of forest lands. (AGRO). [Source: J. Dunster and K Dunster via Eric Boa and Renate Prüller]
4. The change of land use from forest to other land-use or depletion of forest crown cover to less than 10%. [Source: from http://faov02.fao.org:70/0gopher_root%3a[fao.fra]def_uk.txt (concepts, definitions and methodology of the FAO Forest Resources Assessment 1990) via Bernhard Schlamadinger]
5. (Developed countries): Change of forest with depletion of tree crown cover to less than 20 percent. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger]
6. (Developing countries): Change of forest with depletion of tree crown cover to less than 10 percent. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger]
7. (Canada - BC) Clearing an area of forest on a non-temporary basis for another use. Clearcutting (even with stump removal), if shortly followed by reforestation for forestry purposes, is not deforesting. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
8. The temporary or permanent clearance of forest for agriculture or other purposes (Grainger 1993). In contrast, most 'logging' in tropical rain forests is selective, removing relatively few trees per ha, and therefore does not permanently cause deforestation. However, poorly implemented logging does cause forest degradation.

Deforestation is more a land use problem than a forestry problem. Attempts to ban logging as though this would stop deforestation are misguided. [Source: via Finchley]

9. Clearing of forest from large tracts of land which consequently remains unforested either as barren land or as agricultural crop. [Source: Bruening via Renate Prüller].
10. Conversion of forest land to other land use. [From: Schlamadinger Bernhard uvu@ornl.gov Date: Tue, 9 Jun 1998 18:02:09 -0400 (EDT)]
11. (Canada - Sask.) [deboisement (n.m.)] Permanent removal of forest cover and withdrawal of land from forest use, whether deliberately or circumstantially. [Source: Silvicultural Terms in Canada - Second Edition 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]
12. (India) Removal of forest cover from a forest land. It excludes clearfelling. [Source: Glossary of Technical Terms, Forest Research Institute, India. From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]

Discussion: Definitions 2, 3, 4, 7, 8, 9 and 11 have time factors built in. Definitions 1,5 and 10 do not. Definitions 4, 5, 6, and 12 carry a reduction in canopy cover clause. Definition 10 does not say anything about reduction in tree cover - just a conversion of land use. See also the Comparative Study on Terminology related to Forest Resources Management, which was prepared last year within the IUFRO Secretariat, with in particular one chapter on deforestation'. [Source: Via Renate Prüller and Tobias Zorn].

PLANTATION (Forest Cultures)

1. (UN-ECE/FAO) Forest stands established by planting or/and seeding in the process of afforestation or reforestation. They are either: - of introduced species (all planted stands), or - intensively managed stands of indigenous species which meet all the following criteria: one or two species at plantation, even age class, regular spacing. Excludes: stands which were established as plantation but which have been without intensive management for a significant period of time. These should be considered semi-natural. [Source: UN-ECE/FAO 1997]
2. (Artificial crop, artificial stand ~ man-made forest) - A stand raised artificially, either by planting or by direct sowing. [Source: David South]
3. (Ukraine) Forest stands created by planting of seedlings, saplings of trees or shrubs or by sowing of their seeds", i.e. it here this means only origination of stands, not intensity of management. [Source: State Standard of Ukraine, DSTU 2980-95 ``Forest plantations. Terms and definitions", being in force since 01.01.96. From: "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Sat, 28 Mar 1998 21:09:08 +0200 (UKR)]
4. Usually large group of plants and especially trees under cultivation. A place that is planted or under cultivation [Source WWWebster 11 June 1998]
5. Forest areas lacking most of the principal characteristics and key elements of native ecosystems as defined by the Forest Stewardship Council -approved national and regional standards of forest stewardship, which result from the human activities of either planting, sowing or intensive silvicultural treatments. [Source: http://www.fscoax.org/html/1-2.html From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500]

6. (UK) Woodland where the current trees have been planted. Often includes naturally regenerating trees as well. Includes former semi-natural woodlands restocked by planting [Source: THE UK FORESTRY STANDARD. The Government's Approach to Sustainable Forestry, EDINBURGH: FORESTRY COMMISSION, 1998 http://www.forestry.gov.uk/standard.html and http://www.forestry.gov.uk/standard.pdf From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500 and "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Tue, 23 Jun 1998 21:04:18 +0300 (MSD)]
7. (Great Lakes - St. Lawrence Region (Canada)) Tree-dominated vegetated areas in which human intervention, through planting or intensive silvicultural treatments, has yielded conditions in which only a few of the characteristics of the indigenous natural forest ecosystem remain. [Draft standards for the Great Lakes - St. Lawrence Region (Canada) http://www.web.net/fscca/s5.htm From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500]
8. (U.S. Pacific Coast region) - Tree-dominated areas substantially lacking in natural forest attributes (e.g., structure, and species composition native to the area) and that usually require human intervention. A "planted forest" is not necessarily a "plantation," since it may attain natural forest attributes. In the Pacific Coast region, any of the following characteristics may indicate that a forest is a plantation (though not necessarily one that is certifiable): Cultivation of exotic species.
   Use of even-aged silviculture for forest types that do not regenerate naturally through stand-replacing events.
   Use of even-aged silviculture with rotations of less than 60 years.
   Use of even-aged regeneration units larger than those specified under criterion 9.2.
   Systematic use of and reliance on chemical herbicides, pesticides, and fertilizers.
   Single-species plantings on sites normally occupied by multiple-species forests.

   Regular, periodic stand treatments intended to eliminate natural ingrowth of native trees and associated ground vegetation. [Draft standards for the Pacific Coast Region (US) From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500]
9. Plot of land occupied by fast-growing or `technical' forest species with the aim of producing timber with short rotation or producing bark, (willow) withes, seeds, grafts etc. our term <[forest] plantation can be translated to English as -- [forest] plantation, -- seed orchard.... [From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]
10. (U.S.A.) Areas dominated by trees planted on a regular and generally consistent row and plant spacing. Stands are planted for the purpose of producing a crop of timber, Christmas trees, or other products. Examples include planted hardwood and softwood timber stands. [Source: http://biology.usgs.gov/fgdc.veg/standards/appendix3.htm]
11. Forest stands that have been established artificially to produce a forest product crop. They are either on lands that previously have not supported forests for more than 50 years (afforestation), or on lands that have supported forests within the last 50 years and where the original crop has been replaced with a different one (reforestation). [Source: S. Brown, A.E. Lugo and J. Chapman (1986), Biomass of tropical tree

plantations and its implications for the global carbon budget, *Canadian Journal of Forest Research*, vol. 16, pp. 390-394]

Discussion: If the first definition is taken literally, plantations can only occur on areas that have been either deforested or never forested. The question comes up about the calling of land that is recently clear cut and immediately replanted lands that were deforested and then reforested. See definitions and discussion of ***deforestation*** above. Also, South points out that the first definition does not allow a 3 species plantation. The remaining definitions appear to apply to any lands. Definitions 10 and 11 do not include sowing. Definition 11 has economic and harvest implications through the use of the term "crop."

REGENERATION

1. An act or the process of regenerating : the state of being regenerated [Source WWWebster 11 June 1998]
2. All types of natural recovering of forest vegetation on forest lands (without special seeding or planting), the natural one (seeds or coppice) or with the help of men by means of different types of forest activities such as scarification, stripes or gap cuttings, etc. [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
3. Process of formation of new generation of forest by natural way (in word-by-word translation) [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
4. (Czech Republic) A set of measures resulting in the development of a new generation of forest stand. [Source: Act on Forests and Amendments to Some Acts (the Forest Act) dated 3 November 1995. Ministry of Agriculture of the Czech Republic. Prague, 1996. 58 pp. From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 11:32:47 +0300 (MSD)]
5. (Canada - Sask.) Renewal of a forest stand (i.e. establishment of new young trees) by natural or artificial means. [Source: the Saskatchewan Long-term Integrated Forest Resource Management Plan March 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]
6. (UK) Renewal of woodland through sowing, planting, or natural regeneration. [Source: THE UK FORESTRY STANDARD. The Government's Approach to Sustainable Forestry, EDINBURGH: FORESTRY COMMISSION, 1998 http://www.forestry.gov.uk/standard.html and http://www.forestry.gov.uk/standard.pdf From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Tue, 23 Jun 1998 21:04:18 +0300 (MSD)]
7. (UK) (Natural Regeneration) - Plants growing on a site as a result of natural seed fall or suckering. The term is also used to describe the silvicultural practices used to encourage natural seeding and successful growth of the seedlings. [Source: THE UK FORESTRY STANDARD. The Government's Approach to Sustainable Forestry, EDINBURGH: FORESTRY COMMISSION, 1998 http://www.forestry.gov.uk/standard.html and http://www.forestry.gov.uk/standard.pdf From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Tue, 23 Jun 1998 21:04:18 +0300 (MSD)]

Discussion: Definitions 2, 3 and 7 indicate that regeneration is a natural process. Def. 4 does not specify. Definition 5 and 6 allow any method.

SEMI-NATURAL FOREST

1. A stand which is composed predominately of native trees and shrub species which have not been established by artificial regeneration methods. Semi-natural forests do not include forest land that is "undisturbed" by man. [Source: David South]
2. A stand which is composed predominantly of native trees and shrub species which have not been planted. Also, a forest which has developed gradually or accidentally, as its location or site quality was not suited for intensive exploitation or production-oriented management (e.g. in mountainous regions). This kind of reconstruction of the natural forest cover can be or has been achieved by using various silvicultural practices e.g., natural regeneration or selective thinning and in some cases also planting. [Source: Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

Discusssion: Both definitions exclude plantations and include only native trees and shrubs.

STOCKING

1. (Russia) - Degree of a denseness of growing of trees in a tree stand describing a share of use by them of taken space. Usually under definition of stocking (polnota) understands a relative polnota of a tree stand - ratio of the sum of areas of cross-cuts of all trees of a tree stand at height of 1.3 meters (breast-height) on 1 ha to the sum of areas of cross-cuts of a normal tree stand (with a polnota 1,0), i.e. tree stand with optimum for the given species and types of forest growing conditions the sum of areas of cross-cuts, which undertakes from the tables of growth. . [From: " Russian Forest Encyclopedia" "Igor Yakovlev" yakovlev@mari-el.ru Date: Sat, 6 Jun 1998 21:16:59 +0400]
2. The sum of areas of cross-cuts of all trees of a tree stand at height of 1.3 meters (breast-height) on 1 ha' is basal area. [From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]
2. (Canada - BC) A measure of the area occupied by trees, usually measured in terms of well- spaced trees per hectare, or basal area per hectare, relative to an optimum or desired level. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]
4. (Canada) A qualitative expression of the adequacy of tree cover on an area in terms of crown closure, number of trees, basal area or volume in relation to a pre-established norm. [Source: Criteria and Indicators of sustainable forest management in Canada: Glossary http://www.nrcan.gc.ca/cfs/proj/ppiab/ci/gloss_e.html From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]
5. A relative number of trees or volume per acre. A forest stand is most often described as being well-stocked, poorly stocked or overstocked. [Source: Glossary of Forestry Terms Commonly Used in Forest Management Plans

http://ww.ehnr.state.nc.us/EHNR/DFR/fm-22.htm From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]

6. The amount of live trees on a given area in relation to what is considered the optimum. [Source: USDA Forest Service General Technical Report WO-44. Forest Stand Density and Stocking: concepts, terms, and use of the stocking guides. 8 p.]

OTHER TERMS

Damaged forest - Forest which is prevented by negative influences from natural development of the ecosystem or prevented from providing the functions of a forest. Damaged forest is forest for reclamation and is a threat to the environment under the terms of regulations on the protection of the environment. [From: Slovenian LAW ON FORESTS - Milan SINKO milan.sinko@UNI-LJ.SI via "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Fri, 12 Jun 1998 16:11:17 +0300 (MSD)]

Established forest stand – The reaching such a state of forest stand where intensive protection is no longer required after afforestation and the number of individual trees and their distribution throughout the forested area, as well as the composition of the forest tree species, create all the prerequisites required for the establishment of a site suitable forest stand. [Source: Act on Forests and Amendments to Some Acts (the Forest Act) dated 3 November 1995. Ministry of Agriculture of the Czech Republic. Prague, 1996. 58 pp. From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 11:32:47 +0300 (MSD)]

Forest cultures - Artificially created or planted forest stands. [From: "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]

Forest fund - All the lands given to state forestry enterprises plus all the forests under responsibility of other bodies. Or, all the forest lands plus non-forest lands of state forestry enterprises.

- forest [lands]: covered by forest (tree and shrubs) vegetation; not covered by forest vegetation but required to be afforested (cuttings [places after fellings], burnings, [loose forests], [empty places] etc., forest roads, cuttings [narrow straight road dividing quarters in forest], fire breaks;
- non-forest [lands]: under buildings connected with forest management, power lines, pipelines, other underground communications, etc.; agricultural lands (arable lands, hayfields, pastures, given for the purposes of forestry [forest management]; wetlands and waters within the parcels of forest fund given for the purposes of forestry." [From: ``The Forest Code of Ukraine" Kiev, 1994, 56p. "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]

Forest management – The regeneration, protection, tending and felling of forest stands and other activities securing the fulfillment of forest functions, [Source: Act on Forests and Amendments to Some Acts (the Forest Act) dated 3 November 1995. Ministry of Agriculture of the Czech Republic. Prague, 1996. 58 pp. From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 11:32:47 +0300 (MSD)]

Other wooded land (including "non-productive forest land" and "wooded mire") - Areas with an annual yield capacity between 0.1 and 1 m3 wood including bark per hectare under favourable stand conditions. As for productive forest land, consideration should be given to yield capacity and not a temporary absence of trees. [From: Stein Tomter stein.tomter@tor.nijos.no Date: Mon, 15 Jun 1998 14:50:20 +0200]

Non covered by forest forest lands - Lands designated for forest growing, i.e. felled places, loose forest, `not closed yet young forest cultures", etc. All these land were potentially needed to be reforested/afforested/reconstructed. [From: ``The Forest Code of Ukraine" Kiev, 1994, 56p. "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]

Productive forest land - Land which has an annual yield capacity of at least 1 m3 wood including bark per hectare under favourable stand conditions. Classification should not be affected if the land is temporarily without trees. More critical factors are the yield capacity and that the land is not utilized for other purposes than wood production. [From: Stein Tomter stein.tomter@tor.nijos.no Date: Mon, 15 Jun 1998 14:50:20 +0200]

Renewal - The natural or artificial renewal of any forest product and includes reforestation" [Source: Chapter F-19.1: An Act respecting the management of Forest Resources...aka THE ACT From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600])

Stand -The basic unit of spatial arrangement of the forest identifiable in the terrain and shown on a forestry map. [Source: Act on Forests and Amendments to Some Acts (the Forest Act) dated 3 November 1995. Ministry of Agriculture of the Czech Republic. Prague, 1996. 58 pp. From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 11:32:47 +0300 (MSD)]

Virgin forest = untouched forest - An area that has never been disturbed by human intervention, and is showing natural development in structure and dynamics. The soil, climate, entire flora and fauna and the life processes have not been disturbed or changed by timber management, cattle grazing, or other direct or indirect anthropogenic influences. . [Source: Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

CONTACTS AND ADDITIONAL SOURCES:

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Boa, Eric. CABI Bioscience, "Eric Boa (BMP-PDN)" <E.BOA@cabi.org
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'Terms and Definitions for the follow-up of the Second Ministerial Conference on the Protection of Forests in Europe'. We put it together with Andreas Schuck in 1994. It is not referred to as EFI work, but I have seen it for instance in FAO Working Group on Forestry Statistics proceedings, Rome Italy 20-24 November 1995 by Pekka Patosaari, who 'ordered' the work from EFI in 1994. Via Brita Pajari.

On a related subject, Roger Leakey has published a new definition of agroforestry in 1996 - see Agroforestry Today, 8(1): 5-7 (via Roger Leakey).

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Q5.3 Please explain the nature of "decisions on land-use changes and forestry" that you believe should be considered and taken by the COP.

A5.3 Net greenhouse gas emissions from land use change and forestry are currently inadequately documented—both because of poor guidelines for reporting on these sectors, and because of uncertainties with regard to actual net emissions. In the Administration's view, a work program must be developed both to improve our underlying understanding of the science of emissions by sources and removals by sinks from these sectors, and to develop proper reporting guidelines for inventorying such emissions and removals. The COP, working through the SBSTA and jointly with the IPCC, is expected to agree on a regime for properly monitoring and reporting on these emissions. Initial decisions on this work proigrtam were taken in Bonn at the eighth session of SBSTA; these decisions, and additional recommendations are likely to be approved by COP-4 in Buenos Aires, and final agreement, based on the outcome of this work program are likely to be agreed at COP-5 and COP-6.

Q5.4 When do you contemplate such decisions to be made?

A5.4 We anticipate decisions on land use change and forestry being taken in a number of different fora: Scientific recommendations and modifications to the IPCC guidelines would be taken by the IPCC; technical decisions affecting the FCCC would be taken by the SBTSA and formally adopted by the Conference of Parties; and decisions affecting the Protocol could be taken in some cases by the Conference of the Parties to the FCCC, and in other cases by the Conference of the Parties to the FCCC serving as the meeting of the Parties to the Protocol. Decisions could be taken by the IPCC at plenary sessions over the next several years, decisions by the SBSTA could be taken at their next session (on the margins of COP-4 in Buenos Aires in November 1998) or in meetings in 1999 and subsequently. We do not anticipate formal decisions proposing to establish agreed definitions for "afforestation", deforestation" or reforestation" to be taken until at least COP-5 in late 1999.

Q5.5 Please provide a copy of any U.S. "comments" provided to the Secretariat with respect to paragraph 5 of document FCCC/SBSTA/1998/CRP.3 cited above.

A5.5 Attached please find a copy of the U.S. comments submitted to the FCCC in response to the request of FCCC/SBSTA/1998/CRP.3. *[Note: This paper is contained in document FCCC/CP/1998/MISC.1, pp. 54-48.]*

PAPER NO. 10: UNITED STATES OF AMERICA

METHODOLOGICAL ISSUES RELATED TO LAND USE CHANGE AND FORESTRY AND THE KYOTO PROTOCOL

At the eighth session of the Subsidiary Body for Scientific and Technological Advice in Bonn, Germany, the Parties agreed in FCCC/SBSTA/1998/CRP.3, paragraph 5,

> *The SBSTA invites Parties to submit information related to: (a) The implementation of Article 3.3, particularly on data and methods, and questions and issues identified in FCCC/SBSTA/1998/INF.1, by 15 August 1998 for compilation into a miscellaneous document by approximately August 30, 1998;*

The U.S. notes the progress made in Bonn regarding LUCF activities, in particular, the decisions to: 1) clarify Article 3.3 (FCCC/SBSTA/1998/CRP.3, paragraph 2); invite parties to submit information relating to LUCF activities; 3) task the IPCC with a special report; and 4) request SBSTA to organize workshops on LUCF activities.

This U.S. submission covers the following general areas:

1) Kyoto Protocol language related to forests, land use, and land use change;
2) Recommendations for the IPCC Special Report;
3) Guidance on the Article 3.3 workshop, September, 1998;
4) Recommendations for the workshop to focus on Article 3.4; and
5) A timetable for moving forward on Articles 3.3 and 3.4 of the Kyoto Protocol

1) Kyoto Protocol language related to forests, land use, and land use change:

The United States continues to seek full and comprehensive treatment of all anthropogenic emissions and sinks of greenhouse gases under the Framework Convention and under the Kyoto Protocol. Comprehensive treatment of forests and other lands uses, including agriculture, range, and pasture lands, is necessary to ensure that:

- all human activities that influence the concentration of greenhouse gases in the atmosphere are adequately addressed; and

- the most cost-effective mitigation strategies are pursued.

The U.S. recognizes the limited set of activities outlined in Article 3.3 are a step in that direction. However, many questions remain regarding the current language. The informal document FCCC/SBSTA/1998/INF.1 prepared by the FCCC Secretariat, outlines many of the technical and policy questions that we face. The document prepared by the Secretariat goes beyond summarizing the issues regarding land use change and forests in the Kyoto Protocol and offers interpretations of the language. The United States believes that ultimately, the job of interpretation of the text is best left to the Parties. We recognize that, while not explicit in the Kyoto Protocol, it is desirable to seek a common approach among Parties in defining the activities referred to in Articles 3.3 and 3.4 of the Kyoto Protocol. We also recognize the value of the planned IPCC Special Report on LUCF activities and acknowledge that the IPCC's technical work is important to meet the aim of a consistent, scientifically based approach to implementing Articles 3.3 and 3.4 of the Kyoto Protocol. A number of options are available with regard to the language in Articles 3.3, 3.4 and 3.7 especially with respect to key terms. An examination of these options must be guided by the following:

1. **Interpretations should be consistent with the level of commitment Parties agreed to for the first commitment period**. Interpretations adopted for the first commitment period should not produce a departure from the targets negotiated in Kyoto.

2. **Interpretations of key LUCF terms should be based on sound science.** Terms in the Kyoto Protocol should have grounding in the scientific and technical literature. Countries should employ the best practicable technical methods for measuring carbon and other greenhouse gas emissions and sequestration on land use and forestry, and ensure that the emissions and sequestrations reported are monitorable and verifiable. Where data gaps and uncertainties exist, countries should seek to improve understanding and measurements of greenhouse gas emission activity.

3. **Interpretations should promote other environmental objectives related to land use, recognizing tradeoffs and complementarities among environmental goals.** Land use changes and forestry have significant environmental impacts beyond their effects on greenhouse gases. Parties should be alert to creating incentives that affect the broader environment. For example, activities should implicitly encourage sound forest and agricultural management practices along with carbon sequestration. To the extent that optimizing carbon sequestration conflicts with, say, improvements in biodiversity, appropriate balances should be considered and addressed.

4. **Interpretations of land use and forest activities should create appropriate incentives.** To a large extent, the only way to provide the proper environmental and economic incentives is to have an accounting system for sinks that is as comprehensive as possible. Important cost savings may be lost if certain land use activities sequester carbon more cheaply than others, but are excluded from the treaty.

2) Recommendations on the IPCC Special Report:

In FCCC/SBSTA/1998/CRP.3, paragraph 7, SBSTA requested the IPCC to prepare and provide information to the SBSTA and the Conference of Parties, in particular a Special Report as defined by IPCC procedures, on land use, land use change and forestry. The focus of the Special Report should be on the methodological, scientific, and technical implications of alternative interpretations of the relevant articles of the Protocol, particularly Articles 3.3 and 3.4. The special report should use full anthropogenic carbon stock accounting as the reference point for consideration of key terms in the Protocol related to land use, land use change and forestry activities.

In order to meet the needs of the Parties, the special report should include assessments of:

- The overall contributions (short and long run) from land use activities, land change and forestry;
- The implications of the potential approaches for key terms in Article 3.3 of the Kyoto Protocol (including forests, afforestation, reforestation, and deforestation);
- Other activities that should be considered under Article 3.4, including: soil carbon management on forest lands, crop lands, range lands, and pasture lands; improvements in forest management; and conservation;
- Inventory and data availability to report these activities; and
- Shortcomings and limitations of only counting these activities versus full and comprehensive accounting.

To assist in the task of developing potential interpretations, we have provided a compilation of definitions used in the United States and internationally for the terms deforestation, afforestation and reforestation (Lund, 1998; attached). The potential interpretations of the other key forest and land use terms and implied in the Kyoto Protocol are characterized in Section B (1) of FCCC/SBSTA/1998/INF.1. These terms include: direct human-induced; activities; carbon stocks, and forests.

The IPCC should use a set of objective questions as part of the evaluation of alternative interpretations of key terms. For each potential interpretation, the IPCC should address:

- Can inventory methods and reporting guidelines be developed and made available (or are they already available)?
- What are the data requirements and uncertainties for the inventory methods and reporting guidelines?
- What structural problems and accounting gaps exist?
- What are the greenhouse gas mitigation options that are included and excluded?
- What uncertainties exist in our scientific understanding of the effect of LUCF on the carbon cycle?
- Can discounting systems be developed to adjust estimates for uncertainty and risk?

The process of developing this Special Report should provide for close coordination with the SBSTA and allow the SBSTA to provide interim feedback and direction during its development. Mechanisms to facilitate this include: comments provided by the Parties to the Secretariat by 15 August, 1998; additional comments by the Parties in their October 30, 1998 submissions to the FCCC Secretariat; the September workshop; and the workshop on Article 3.4 scheduled for January or February of 1999. A discussion of progress and the need for interim feedback on the IPCC special report should be placed on the agenda of upcoming SBSTA meetings.

3) Guidance on the Article 3.3 workshop, September, 1998

We appreciate the efforts of the FCCC Secretariat and the IPCC in preparing for the workshop scheduled for September 23-25, 1998. The primary outcome of this workshop should be a draft of a detailed outline for the IPCC Special Report (to be forwarded to the IPCC Plenary); agreement on the process for completing and reviewing the special report; and an initial discussion of the specific terms and implications of alternative interpretations between Parties. It should be noted that there will be links between issues raised at the September 1998 workshop, issues that will be raised at the 1999 workshop and the IPCC special report. Workshop preparations should take into account such linkages.

Key items that would be useful as input to the September workshop include:

- A compilation of the August 15, 1998, submissions of Parties by the FCCC Secretariat. The Secretariat should make a presentation of the compilation at the September workshop. This presentation should include, if appropriate, a summary of potential interpretations of key terms offered by the Parties and additional activities proposed under Article 3.4. This presentation should also include a compilation of the views from the Parties on the scope and nature of the IPCC Special Report.

- A presentation by the IPCC on the proposed outline under development for the Special Report on Forests and Land Use Change and the Kyoto Protocol.

- Presentations by 3-5 Parties on the implications of various interpretations of key terms outlined in FCCC/SBSTA/1998/INF.1.

4) Recommendation for a Workshop to focus on Article 3.4. Issues:

The U.S. strongly supports holding a discussion at the September SBSTA workshop to plan the second workshop on LUCF activities, focusing on activities that could be added under Article 3.4. The U.S. has offered to support and host such a workshop in February or March, 1999 and would be pleased to provide additional logistical information at the September workshop about the 1999 workshop. A discussion in September could facilitate ensuring appropriate balance in the Special Report, in particular recognizing that there will be links between issues raised at the Article 3.4 workshop and issues raised at the September 1998 workshop.

5) A timetable for moving forward on Articles 3.3 and 3.4 of the Kyoto Protocol:

To maintain forward movement on LUCF activities, the US has identified a timetable and actions to be taken toward making operational the relevant LUCF articles in the Kyoto Protocol.

August 30, 1998:	Secretariat compiles submissions on Article 3.3. This MISC. document will be available to the Parties at the September Workshop and delivered to SBSTA and COP4.
September 23, 1998:	Workshop on Article 3.3 – discuss alternative interpretations of LUCF activities, identify data needs and gaps; provide guidance for the IPCC Special Report; scope workshop on 3.4.
September 25, 1998	IPCC Plenary , Vienna, Austria. Continue to scope Special Report with input from workshop and submissions by Parties. Approve draft IPCC workplan for special report on Land Use and Forestry under the Kyoto Protocol, noting emendations likely to emerge from Article 3.4 workshop and related submissions.
October 1, 1998	Deadline for submission by Parties on modalities, rules and guidelines for Article 3.4, which may include information on additional categories.
October 30, 1998	Secretariat compiles submissions on Article 3.4. This MISC. document will be available for the Parties at the February/March Workshop and delivered to SBSTA and COP4.
November, 1998:	COP 4—Approve plan of work regarding IPCC Special Report. Deliver MISC. document from September Workshop.
February or March, 1999:	Workshop on Article 3.4. Continue process of identifying additional LUCF activities.
November, 1999:	COP 5—IPCC provides progress report on Special Report or delivers Special Report on LUCF activities. If delivered, Parties should be prepared to agree on 3.3 interpretations and additional activities under Article 3.4 that would be included in the first commitment period (2008-12)
June, 2000:	SBSTA—IPCC delivers Special Report on LUCF activities. Parties should be prepared to agree on operationalizing Article 3.3 and additional activities under Article 3.4 that would be included in the first commitment period.
November, 2000	COP 6 – Partie agree on operationalizing Article 3.3 and additional activities under Article 3.4 that would be included in the first commitment period.

Q5.6 As to the Special Report, I understand that the IPCC has already developed a "Proposed Timetable" that will result in its issuance in June 2000, which is close to the issuance of the Third Assessment. Indeed a July 9, 1998 document, No. 18036/M/IPCC/SRLFC, provides a very extensive "Draft Outline" for the Special Report and states that "broader issues will be addressed in the relevant Working Groups of the IPCC Third Assessment Report (TAR)."

Q5.6.1 What are those "broader issues" that are not covered by the "Draft Outline"?

A5.6.1 The special report on land use, land use change and forestry is to cover a wide variety of topics, as evidenced by the draft outline. Its focus is specific, and principally related to operational questions of how to define aspects of land use change and forestry, and based on these definitions, to propose guidelines for reporting on such activities to promote consistency and compatibility of accounting systems. Thus, tropics such as definitions for afforestation, deforestation and reforestation are included, as are discussions of additional activities in the land use area (e.g., arable land, pastoral and forest land management, and restoration of degraded lands). Furthermore, the report is envisioned to include a section on reporting guidelines, in fulfillment of an IPCC focus on developing appropriate reporting guidance on all aspects of climate change inventorying activities. In support of this operational aspect, the report will also include a section on global issues—including an introductory section examining carbon reservoirs and accounting systems, the role of carbon fertilization, and global trends in land use and land use changes.

In contrast, the IPCC Third Assessment Report has a different focus: it is to consider underlying scientific and technical questions related to the carbon cycle itself—including current efforts to improve the modeling of the cycle. It is to also broadly consider issues related to impacts of and adaptation to climate changes, as well as mitigation options, including with respect to land use, land use change and forestry. Thus the TAR is not operationally focused, nor specifically responsive to a specific FCCC request.

Q5.6.2 Why couldn't all of these issues, including those for the Special Report, be covered by the TAR and thus obviate the need for a new and costly report within the ambit of the TAR?

A5.6.2 The TAR is not structured to address specific operational questions. Rather, it is focused on assessing underlying scientific issues. Issues of operational relevance, such as those envisioned to part of the special report, would thus not be covered. Furthermore, the SBSTA, at its most recent session in Bonn in June, 1998, decided that it was important to have specific answers to operational questions prior to the completion of the TAR (not envisioned until 2001). It thus made a formal request to the IPCC to undertake a special report; IPCC procedures indicate such a report would be completed by late 1999. Costs for such work are anticipated to be relatively small—and mostly met through in-kind contributions of participating governments.

Q5.6.3 What is the urgency for the Special Report, particularly if the Protocol is not ratified and entered into force by 2000?

A5.6.3 The Administration believes that the Protocol is a strong and appropriate step in the international effort to mitigate the serious threat of climate change, even recognizing that it does not fully address all important issues, including the meaningful participation of developing countries, and some procedural and methodological questions. We are thus seeking, as a priority matter, to work on those aspects of the agreement that remain unfinished—including issues relate to land use change and forestry. Inasmuch as these questions are not specifically connected to the Third Assessment Report of the IPCC, it seemed appropriate to have them move forward on independent timetables—each according to the needs of their respective organizations. The IPCC's report was set on a year 2000 timetable to meet the needs of a full assessment; there was no reason to delay the special report on sinks as it could be readily completed more expeditiously.

Length of Time for Negotiations on Rules for Implementing the Kyoto Protocol

Q6. An Article in the July 28, 1998 edition of Air Daily quotes Acting Assistant Secretary of State Melinda Kimble as saying that the negotiations on rules for implementing the Kyoto Protocol will take at least two years. The article then states:

> ***"Meanwhile, an environmental attorney called a slower negotiating pace 'perfectly appropriate' given the host of issues that must be resolved before flexible mechanisms could be put in place. For example, the so-called 'operational entities' that are supposed to verify CERs*** **[Certified Emissions Reductions]** ***can't be named until the Kyoto Protocol goes into effect, said the attorney, Dan Goldberg of the Center for International Environmental Law."***

Do you agree with these remarks?

A6. We agree that there are a host of issues that must be resolved before the flexibility mechanisms become operational. We also agree that this effort could take two years. We note, however, that the provisions of the Kyoto Protocol itself put the flexibility mechanisms in place. Also in our view, the Conference of the Parties under the existing Convention can designate "operational entities" before the Kyoto Protocol enters into force, subject to subsequent confirmation by the Conference of the Parties serving as the Meeting of the Parties to the Protocol.

President Clinton's July 25, 1998 Radio Address on Global Warming Issues

Q7. The President, in his July 25, 1998 radio address on global warming issues, said:

> ***"First, I'm directing federal agencies to work more closely with private contractors to retrofit federal buildings and other facilities with the best energy-saving technology, at no cost to taxpayers. Second, we'll replace hundreds of thousands of conventional light bulbs and fixtures with more efficient fluorescents, which will pay back in energy savings nearly five times what they cost to install. Third, I'm directing all agencies to work toward bringing their existing buildings up to EPA's 'Energy Star' standard of energy efficiency. And fourth, the Defense Department and six other federal agencies will adopt 'sustainable design' guidelines for all new federal buildings to reduce their energy use.***
>
> ***"Now, together these measures will save taxpayers as much as $1 billion a year in energy costs. They'll help to jump-start markets for new technologies, and they'll protect our environment by reducing greenhouse gas emissions."***

Q7.1 In consultation with the Department of Energy, the Office of Management and Budget, and the General Service Administration, please provide more details of such planned retrofits "at no cost to taxpayers," the replacement of conventional light bulbs, and the other actions covered by the President's directive, including the schedule, the buildings affected, and, in the case of the retrofit activities, the estimated annual costs for the scheduled period.

A7.1 The President's radio address set out a plan to decrease Federal building energy use through energy savings performance contracts (ESPC) and other energy saving tools. ESPCs leverage private sector investment and expertise to accomplish energy and cost saving projects in Federal facilities at little or no cost to the taxpayers. Under ESPC authority, Federal agencies hire private businesses to audit facilities, propose energy saving retrofits. and privately finance, install, and maintain retrofits. Contractors guarantee savings and are paid from a share of the savings; remaining savings return to the taxpayers and the agency.

The Department of Energy and the Department of Defense have a planned ESPC contracting authorioty of $9 billion to help Federal agencies reduce energy use to 30% below 1985 levels by 2005. Under the DOE's ESPCs, work on any Federally-owned building can be ordered up until April 2000 and the term of the projects can last up to 2023. DOE is currently working with 16 agencies to develop over 140 ESPC projects across the country.

There is another effort to purchase and install an additional 100,000 compact fluorescent bulbs for each of the next three years, which will generate electricity cost savings of $13.5 million, and cut 40,000 metric tons of carbon emissions over the life of the bulbs. Also, ESPC's can be used to save an additional $10 million dollars a year for three years in energy costs by upgrading old-style institutional lighting fixtures. This will prevent up to 600,000 metric tons of carbon emissions over the life of the fixtures.

Q7.2 Please provide a copy of the Presidential directive and the analysis that supports the President's statement that "together these measures will save taxpayers as much as $1 billion a year in energy costs savings."

A7.2 A copy of the Presidential directive is attached.

The analysis that supports the President's statement that "together these measures will save taxpayers as much as $1 billion a year in energy costs savings" was developed through the DOE Office of Energy Efficiency and Renewable Energy's Government Performance and Results Act Quality Metrics process. In this process energy cost savings are estimated from primary energy displaced from a baseline year (1995).

(Please also find attached the Dept. Of Energy publication entitled "Federal Energy Efficiency and Water Conservation Funding Study upon which this answer was drawn.)

THE WHITE HOUSE
Office of the Press Secretary

For Immediate Release July 25, 1998

July 25, 1998

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

SUBJECT: Cutting Greenhouse Gases through Energy Savings Performance Contracts

My Administration has made addressing the threat of global climate change one of our top environmental priorities. As the Nation's largest consumer of the fossil fuels that scientists believe are driving global warming, the Federal Government has a special responsibility to lead in developing clean energy solutions and in reducing Federal energy consumption. While Government-wide energy saving activities over the last several years have resulted in significant achievements, we can and should do more.

On March 9, 1994, I issued Executive Order 12902, Energy Efficiency and Water Conservation at Federal Facilities, which directed all executive agencies to reduce energy consumption 30 percent below 1985 levels by the year 2005. We have made significant strides, but in order to achieve this goal we must make better use of a critical energy management tool. Energy Saving Performance Contracts (ESPCs), which are authorized under the National Energy Conservation Policy Act, as modified by the Energy Policy Act of 1992, provide significant opportunities for making Federal buildings more energy efficient at little or no cost to taxpayers. Under ESPC authority, agencies can contract with private energy service companies to retrofit Federal buildings with no up-front payments by the Government. These companies recover their costs from a negotiated share of the energy cost savings, with the remaining savings being returned to the contracting agency and to taxpayers. The Federal Government must make more use of these highly cost-effective contracts.

I therefore direct all Federal agencies to maximize use of this authority by the year 2000, when the authority expires. I also direct the Department of Energy (DOE) to lead an interagency effort to develop a legislative proposal extending ESPC authority past the year 2000. As part of this effort, I direct all agencies to identify and propose areas for expansion of ESPC authority -- for instance, as appropriate, to some leased buildings, mobility, and other Federal assets. In addition, I direct agencies to propose ways to procure electricity produced using cost-effective renewable sources.

While ESPC authority has existed for some time, I have encouraged significant steps to streamline and promote greater use of this tool. To this end, the DOE and the Department of Defense (DOD) have negotiated contracts with energy service companies over most regions of the country. These ESPCs currently allow up to $5 billion worth of projects at Federal facilities within these regions. The DOE and the DOD anticipate that by the end of this year they will negotiate contracts allowing an additional $2.7 billion worth of such work in specific regions. The combined $7.7 billion provides, in effect, the total dollar amount of retrofit projects that Federal agencies can complete at their facilities using ESPCs. In addition, the DOE anticipates negotiating over $1 billion for ESPCs to finance the installation of renewable energy and other efficient technology systems in the near future.

To further compliance with this directive, I have asked the Office of Management and Budget to provide new guidance to agencies that will help remove barriers and provide more incentives for using ESPCs. This guidance will change the budgetary treatment of these contracts to be consistent with the unique statutory authority for ESPCs. Specifically, the full amount of budget authority for the contract will no longer be needed up front, but can be made available over a number of years: In addition, this guidance will encourage agencies to permit up to 50 percent of the energy savings from ESPCs to remain at the facility or site where they occur. Both of these policies will help motivate Federal energy managers to make greater use of ESPCs and reduce agency operating costs.

To make use of this authority, Federal facilities need to contact the DOE or the DOD to engage contractors already pre-approved to complete ESPC work. Agencies can also consider using direct appropriations or contract with their local utilities. I also direct Federal agencies to maximize efforts to earn an ENERGY STAR label, demonstrating to the public that they rank in the top 25 percent for building energy efficiency. Combining energy savings contracting authority with utility programs and agency funded efforts can save taxpayers as much as one billion dollars a year in energy costs over the next 15 years, and can reduce greenhouse gas emissions by up to 3 million metric tons of carbon annually.

To ensure the full use and benefits of ESPC authority, I further direct each executive agency to submit to me, in the next 90 days, a memorandum detailing:

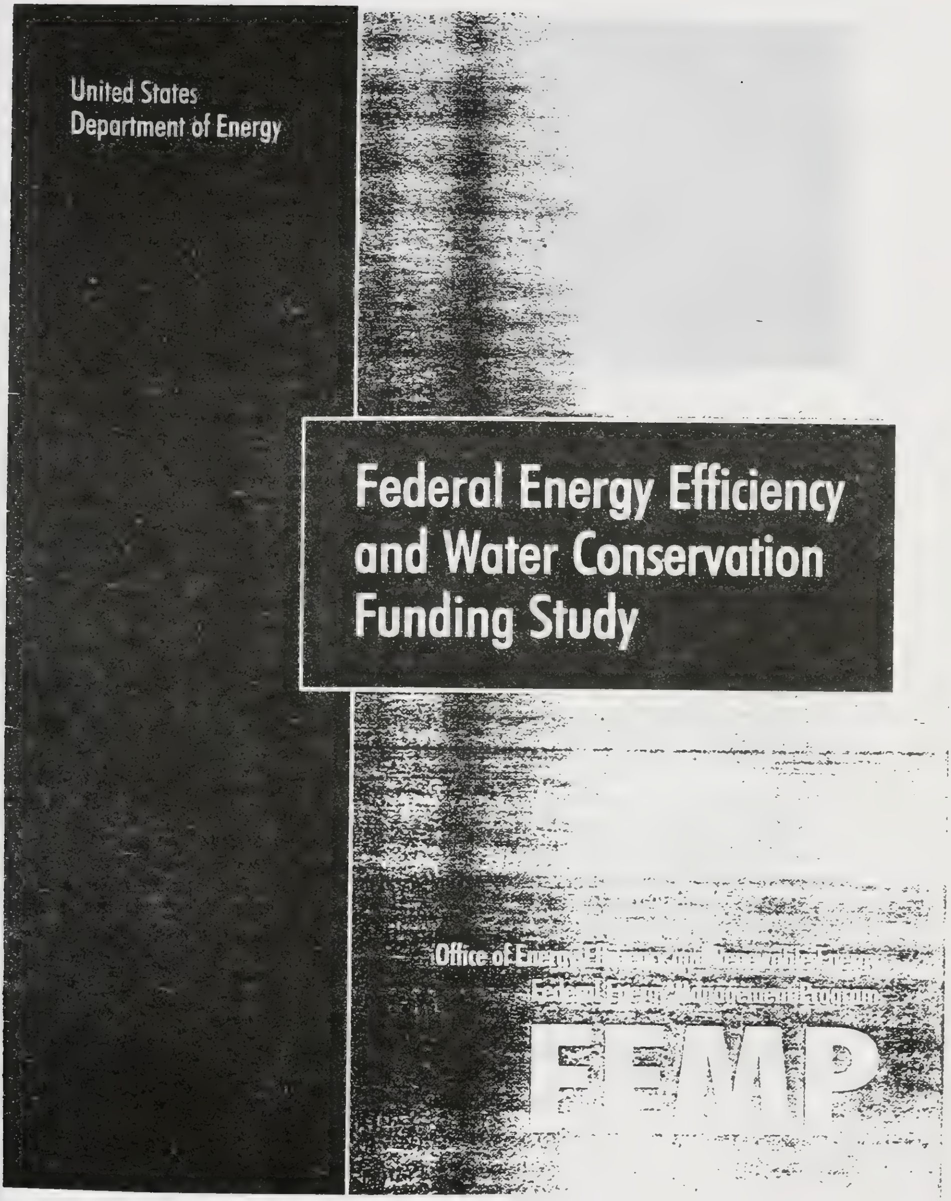
1. Your agency's accomplishments in reducing energy consumption since 1985, and your plans to reduce energy consumption 30 percent below 1985 levels by 2005, in compliance with Executive Order 12902;

2. Your agency's plans to use ESPCs and other tools, as well as your plans to achieve ENERGY STAR labels for your facilities, as part of your increased attention to saving money through energy efficiency and renewable energy;

3. Your proposals on how to expand the Federal Government's use of these tools, for inclusion in our request to the Congress for extending ESPC authority beyond the year 2000; and

4. Your strategy for encouraging use of ESPCs and other financing mechanisms to install renewable energy production systems -- such as those called for in the Million Solar Roofs Initiative.

WILLIAM J. CLINTON



United States
Department of Energy

Federal Energy Efficiency and Water Conservation Funding Study

Office of Energy Efficiency and Renewable Energy
Federal Energy Management Program

FEMP

Federal Energy Efficiency and Water Conservation Funding Study

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Introduction

This report contains the results of a study required by section 162 of the Energy Policy Act of 1992 (EPAct). It outlines options for financing energy and water conservation measures at Federal facilities as required by Part 3 of Title V of the National Energy Policy and Conservation Act (NECPA) (42 U.S.C. 8251 et seq.) as amended by EPAct. It addresses:

1) the estimated Federal financial investment necessary to install energy and water conservation measures to meet NECPA and Executive Order requirements;

2) the use of revolving funds and other funding mechanisms which offer stable, long-term financing of energy and water conservation measures; and,

3) the means for capitalizing such funds.

On March 8, 1994, President Clinton signed Executive Order 12902. This Executive Order is an aggressive mandate to improve energy efficiency and water conservation in Federal buildings nationwide. This Executive Order is designed to meet and exceed requirements for Federal energy and water efficiency that were contained in section 152 of EPAct. Section 152 mandated that Federal agencies use all cost effective measures with less than a ten year payback to reduce energy consumption in their facilities by 20 percent by the year 2000 compared to 1985 levels. In addition, Executive Order 12902 established a requirement to use cost effective measures to reduce energy use by fiscal year 2005 by 30 percent compared to 1985 energy use.

Both the EPAct and Executive Order reduction goals use 1985 as the baseline year. The baseline consumption in 1985 was 469.2 trillion Btus for Federal building energy use. By the year 2000, the consumption should approach 356 trillion Btus and 311 trillion Btus in 2005. Consumption goals in Btus per gross square foot (Btu/GSF) for the year 2000 are 111,878 Btu/GSF and 97,893 Btu/GSF in 2005. To achieve these goals, substantial investment in energy efficiency and water conservation will be required. The sources for this investment include: direct appropriations to agencies, private investment from energy savings performance contracts, utility investment from demand-side management programs, and appropriations to the Federal Energy Efficiency Fund.

Executive Order 12902 encourages and directs agencies to seek innovative non-Federal help in reducing their energy and water consumption. Section 401 of the Executive Order calls for the use of innovative financing and contractual mechanisms such as utility demand-side management programs and energy savings performance contracts. As noted in a March 1994 Office of Technology Assessment paper for the House Committee on the Budget, one of the major constraints to implementing more energy efficiency practices in the Federal government is the shortage of funds to invest in energy efficient equipment.

This report will provide estimates for the energy and water conservation investments needed to achieve the NECPA and Executive Order goals as well as estimates for the contribution from various funding sources and a review of the mechanisms for funding these investments.

Findings

Estimating the investment necessary to achieve these goals and the likely source of funds for such investments requires evaluation of many dynamic variables. To estimate the amount of funds likely to be available, these variables include the amount of funding to be provided by direct appropriations to agencies as well as the level of non-Federal funds that will be available from utility programs and energy savings performance contracts. While historical information can provide indications of current funding, projections of future funding levels are much less certain. To estimate the total investment necessary to achieve the established goals, the variables would include the cost of energy and water, the energy and water conservation techniques, and the penetration of those techniques within the Federal sector. To reflect these many uncertainties, this report provides best estimates of investment requirements and funding sources, as well as an upper and lower level for each estimate. The range within these upper and lower bounds reflects the uncertainty of these estimates.

Based on an evaluation of the life-cycle cost effective energy and water conservation projects required to meet the NECPA and Executive Order goals, the best estimate of the total investment required between 1996 and 2005 is $5.7 billion. This value could vary from a low of $4.4 billion to a high of $7.1 billion given the variability in both the energy and water investment requirements.

The best estimate of the total funding available from various sources to meet the energy and water investment needs between 1996 and 2005 is $3.7 billion. This value could vary from a low of $1.8 billion to a high of $4.5 billion given the variability of the three primary sources of funding: direct appropriations, energy savings performance contracts, and utility demand-side management programs.

Using the "best estimate" values for both the required investment and funding availability, there would be a shortfall of $2.0 billion in the funding necessary to achieve the NECPA and Executive Order goals. However, given the variability of the estimates, the shortfall could be as large as $5.3 billion or, in the best case, there may be no shortfall.

The table below summarizes the predicted values and the possible range of values for each investment account or funding source.

Investment and Funding Totals from 1996 to 2005 (in billions)

Investment Needs		Range			
	Best Estimate	High-End Investment		Low-End Investment	
Energy Investment	$4.6	$5.5		$3.7	
Water Investment	$1.1	$1.6		$.7	
Total	$5.7	$7.1		$4.4	
Expected Sources of Funding					
	Best Estimate	Low-End Funding	High-End Funding	Low-End Funding	High-End Funding
Direct Agency Appropriations	$2.4	$1.4	$2.8	$1.4	$2.8
Energy Performance Contracts	$.9	$.3	$1.2	$.3	$1.2
Utility Demand Side Management	$.4	$.1	$.5	$.1	$.5
Total	$3.7	$1.8	$4.5	$1.8	$4.5
Shortfall	$2.0	$5.3	$2.6	$2.7	$0.0

Energy Efficiency Investment Requirements

The techniques used to estimate energy savings potential and investment requirements are not based upon a comprehensive survey of Federal facilities. Instead, sampling and statistical techniques are used to derive the estimates that should accurately reflect the level of magnitude of funding required for future years.

The accuracy of these estimates is best captured by presenting the range of estimates for funding needs and expected sources of funding. As comprehensive facility surveys are conducted in accordance with the requirements of Executive Order 12902 these ranges and estimates can be further refined.

The estimates of energy efficiency investment are based upon two sources:

- 1993 US Army Corps of Engineers Renewables and Energy Efficiency Planning (REEP) Model;
- 1994 Pacific Northwest National Laboratory (PNNL) Estimates of Energy Efficiency in the Federal sector.

These two sources present a range of Btus saved annually per dollar invested from 18,071 to 19,441. These values are probably slightly higher than the Federal sector as a whole due to the model's treatment of central heating plant and overseas energy pricing issues. Considering these issues, a more realistic value, and the value used in this study, is 15,000 BTU saved annually per dollar invested. This value of annual savings per dollar invested will be used in conjunction with the energy reduction requirements of 34 TBtus from an estimated 1996 consumption to that of the year 2000 and 69 TBtus by 2005 to determine the required investment. These energy reduction requirements translate into BTU/GSF goals of 111,878 by 2005 and 97,893 by 2005.

Of these two sources, the REEP Model evaluated 72 energy conservation opportunities (ECOs) from 8 categories across 237 Department of Defense installations. This sample represents on the order of 60 percent of all Federal Government floor space. May 1994 computer modeling results reflect a potential savings, for this sample, of $554 million per year with a total investment of $2.867 billion. A non-discounted return on investment of approximately 2.7 was calculated for this study, indicating that the efficiency measures would pay back over two and one half times their original value. The discounted return on investment indicated that the savings would be approximately two times the original investment. (See Appendix A for an illustration of the effect of discount rates on savings projections.) Annual energy savings are predicted at 49.6 TBtus per year. The Department of Defense uses 71.6 percent of the total Federal government's building and facility energy. Assuming the efficiency measures projected to be implemented at the 237 installations analyzed represent the Department of Defense full 30 percent energy use reduction obligation at those facilities and that these measures represent all measures with less than 10 year payback periods, the total Federal government investment required between 1995 and 2005 to meet the savings requirements would be $4.8 billion. Reducing this amount for investments made in 1995, the required investment for all energy efficiency measures from 1996 through 2005 is on the order of $4.6 billion. This estimate may vary in either direction on the order of $900 million due to uncertainty in energy prices for overseas installations, the treatment of central plants retrofit potential, and the estimates for dispersion of economic retrofit opportunities in specific facilities.

Water Conservation Investment Requirements

Estimating water conservation potential is much more difficult than estimating energy savings potential because similar data is not available for water projects. The gaps in available data include: 1) lack of usage and cost data collected by Federal agencies; 2) lack of readily available market cost data due to local availability of water; 3) lack of data on existing investment by agencies for capital or operational improvements in water conservation; 4) lack of data on the potential for third party financing from utilities, and state and local governments, and 5) lack of data on the potential for water conservation performance contracts. The one current principal source for information on water conservation in the

Federal sector is the Environmental and Energy Study Institute's (EESI) June 1993 report, "Water Efficiency in Federal Facilities and Programs." Based upon a survey of some Federal agencies, the report estimates that the Federal water/sewer bill approaches $1 billion. The report further estimates that reducing water consumption by 10 -15 percent by implementing all retrofits with payback periods up to 20 years could save the government up to $150 million annually. Since the NECPA requirement, as amended by EPAct, includes the installation of all water conservation projects with less than a ten year payback, and assuming that most (80 percent) water retrofits in the EESI study payback in less than ten years and the savings to investment ratio is similar to the energy conservation measures surveyed (close to 2.0), an investment level of $120 million per year from 1996 to 2005 or $1.1 billion would save the Federal Government $2.2 billion in water costs, over the same period. This estimate may vary as much as $400 million over the ten year period.

Two examples of the potential for water conservation in Federal facilities should be mentioned to demonstrate that substantial savings can be achieved with water conservation retrofits. In one involving a large Federal building in California, an audit has shown that water usage can be reduced by 50 percent and save $24,000 per year. The payback period for the water retrofit is 4.7 years. The second example is a Federal Fisheries Science Center in Washington State. Here water recycling will reduce water use by 90 percent and save over $200,000 per year, with a payback of less than four years.

Title V, Part 3, section 152 of EPAct, which amended NECPA, addresses water conservation by requiring a facility survey and the installation of water conservation measures with payback periods of less than ten years. Section 302 of Executive Order 12902 called for facility prioritization surveys by September 1995 followed by comprehensive facility audits during which 10 percent of an agency's facilities would be audited each year. As each agency conducts these audits over the next decade, water conservation measures will be identified.

Interest and activity have been increasing in water conservation within the utilities serving the Federal sector. A southern California electric utility has teamed up with a local water authority and others on a pilot, territory-wide DSM program directed at the Federal customer. GSA is one of the active participants. Although this pilot is designed to reduce energy consumption, water conservation opportunities will be addressed. In Boston, the Massachusetts Water Resources Authority provided a building water survey of the O'Neill Federal Building. Unlike the electric and gas utilities, which are regulated by state commissions which are the driving force behind the demand-side management programs, water providers are often simply unregulated resellers. As a result, water utilities are likely to need incentives, financial or otherwise, to become fully involved in demand-side management programs for water conservation in Federal facilities. Water shortages and pricing have been the motivators thus far. Extending the authority to enter into Energy Savings Performance Contracts from only energy to water conservation would also help stimulate the installation of water conservation measures.

Funding Alternatives

The four prime sources of funding currently sought for financing energy projects to meet the Federal consumption reduction requirements are:

- Direct appropriations to agencies;
- Demand-side management programs sponsored by utilities;
- Investments by Energy Saving Performance Contractors; and,
- The Federal Energy Efficiency Fund (FEEF).

Direct Appropriations: Given the many budget priorities that compete for energy and water conservation funding, direct appropriations have often not met energy efficiency funding needs. Although NECPA requires each agency, in support of the President's annual budget request to Congress, to specifically identify funds requested for energy conservation measures, such amounts are not always specifically identified in appropriations bills. Most agencies group energy conservation dollars with capital equipment or operation and maintenance funds. In 1995, the Office of Management and Budget laid out a four-year funding plan to increase appropriations for energy efficiency projects within the four largest agencies (General Services Administration, Department of Defense, Department of Energy, and the Department of Veterans Affairs). Based on this funding plan, appropriations from 1995-1998 were projected to reach $1.5 billion. However, the actual 1995, 1996, and 1997 DOE and DOD budgets were less than planned. Furthermore, the plan is approximately $160 million/ year above the average actual expenditures experienced from 1985 to 1995. Taking these factors into account, the conservative range of direct appropriations from 1996 to 2000 is estimated to be $700 million to $1.4 billion. If appropriations continue through 2005, this would result in a total from 1996 to 2005 of $1.4 billion to $2.8 billion.

Energy Savings Performance Contracting: Section 401 of Executive Order 12902 refers to the expected Federal agency use of innovative financing, such as energy savings performance contracting. Assigning a dollar value to available funds under this approach is extremely difficult due to the relatively small penetration of this contracting mechanism within the Federal sector. From FY 1987 through 1994, $44 million has been invested in Federal energy conservation by means of energy savings performance contracts. However, contracting has increased substantially in the last two years, nearly doubling the previous total investment. Based upon what is known, planned projects, and the expected effort to seek and secure additional projects, it is estimated that over $180 million will have been invested between 1996 and the year 2000 and $900 million will have been invested between 1996 and 2005. The total invested by 2005 may be as little as $300 million and as high as $1.2 billion. This includes energy savings performance contracts and innovative utility financing mechanisms. Authority for performance contracts for other than building energy cost savings does not currently exist. However, the extension of such authority from energy to water and other areas could increase the non-Federal investment in water conservation.

Demand-Side Management (DSM): Utility sponsored incentive programs, also known as demand-side management programs, are valuable resources for the Federal sector. DSM activity in the form of customer rebates for energy efficiency investments is concentrated in a few regions, primarily the Northeast, California and the Pacific Northwest. States in other regions that have utilities which operate substantial DSM and incentive programs include: Wisconsin, Texas, Minnesota, Georgia, and Florida. A 1995 assessment showed that 13 utilities account for one-half of all utility DSM expenditures. Five utilities with the greatest expenditures accounted for 25 percent of the total expenditures on DSM. Utility DSM expenditures were expected to increase from 1.0 percent of utility revenue to almost 1.4 percent in 1995, decreasing to 1.2 percent by the year 2001.

With the onset of utility deregulation, many utilities have made aggressive moves to provide energy efficiency services to their customers as part of their utility services. Utilities are providing a variety of services from design to acquisition, installation, operation and maintenance of energy efficient equipment. The utilities are investing in equipment to be installed in Federal facilities and being repaid from the savings. The Energy Policy Act encouraged Federal facilities to take advantage of such incentives.

As demand side management rebates decline the utility incentive programs are likely to increase. Nationally, total expenditures for DSM rebate and other utility incentive programs are estimated to reach approximately $2.6 billion in the year 2001. It is estimated that the utility commitment to DSM and incentive programs will remain constant at $2.5 billion per year from 2001 through 2005. Total utility expenditures from 1991 through 2005 are expected to be near $36.5 billion across all sectors of the economy.

Funding available through DSM and utility incentive programs is not static and varies over time. Annual changes in these programs are common. Some important factors affecting DSM funding levels include: the economy, interest rates, the Clean Air Act, surplus generating capacity, increasing competition among electricity suppliers, integrated resource planning, and the competition between gas and electric utilities. One of the major Northeast utilities which had been very active in DSM programs for the private and public sectors discontinued all such DSM programs in 1995 because it has determined that a surplus in generating capacity exists. Because the utility's end-use purchasing environment is changing, it wants to reposition itself as a full service provider to its customers, offering not only supply and demand side programs, but also a full range of services designed to maintain a solid customer base and maximize stockholders' return on investment. The uncertainty of utility deregulation is having a similar effect across the country.

Although electric utilities are required to report their DSM activities to the Department of Energy's Energy Information Administration (EIA), figures are not available for dollars spent on Federal government buildings specifically. It is estimated that the Federal share will be equal to the Federal building percentage of total domestic building energy consumption, which equals 1.3 percent . Given the expected level of DSM and utility incentive funding available nationwide and the Federal government share of total domestic energy consumption, it is estimated that the Federal building sector should take advantage of approximately $460 million of the funds available from 1996 to 2005, assuming constant DSM and utility incentive funding levels. Given the increase in competition in the electricity supply sector and other pressures on utilities, the estimate for Federal DSM and utility incentive funding could range from a total of $90 million to $450 million over the period from 1995 to 2005.

Federal Energy Efficiency Fund (FEEF): EPAct established the Federal Energy Efficiency Fund as a dedicated centralized fund to provide grants to agencies to meet the NECPA energy and water conservation requirements. The fund provided grants to agencies based on competitively selected proposals. EPAct authorized $10 million in fiscal year 1994, $50 million in fiscal year 1995 and such sums as may be necessary for fiscal years thereafter. Fiscal year 1994 appropriations for the fund were $6 million, and $8 million was appropriated in fiscal year 1995. There has been no funding appropriated for either fiscal year 1996 or 1997.

The fiscal year 1994 appropriations of $6 million were fully subscribed within a six month period. This demand for funds did not include requests from the Departments of Defense, Veterans Affairs, Energy, and the General Services Administration. Proposals were not solicited from those agencies in fiscal year 1994 in keeping with the intent of appropriation committee language. The fund was oversubscribed in fiscal year 1995 and several high payback projects went unfunded.

While the FEEF represents one of the possible sources of funding for agencies to accomplish energy and water conservation projects, future year FEEF contributions to meet the investment needs are not specifically estimated in this study. Any future year appropriations to the FEEF would serve to minimize any shortfall which would result from insufficient funding from other sources to meet the investment needs. Therefore, appropriations for the FEEF will be considered as part of the funding that would reduce any shortfall.

Establishing a Funding Mechanism

In addition to the importance of having funds available to implement energy and water conservation projects, the mechanism for providing those funds is also important. Different funding mechanisms provide different advantages and disadvantages depending on the capabilities, organization and staffing of the different agencies.

There are several mechanisms available to establish stable, long-term financing of energy and water conservation measures. These include:

1) continue project funding through a variety of formal and informal accounts within each agency;

2) establish a centralized grant making or revolving loan account for use by all agencies; and,

3) a combination of the two options.

Presently, a combination of formal and informal agency accounts, centralized grant making and revolving loan accounts exist within the Federal government to support energy and water conservation projects. An example of the formal account within an agency might be the Department of Defense Energy Conservation Investment Program. An example of the informal account might be any agency's operations and maintenance account which supports the installation of energy or water efficient equipment as part of the normal operations and maintenance activities by the agency. An example of a centralized grant making account is the Department of Energy Federal Energy Efficiency Fund. An example of a centralized, although limited, revolving account would be the General Services Administration Public Buildings Fund.

Each option offers advantages and disadvantages. The advantage of the formal agency account is that agencies can establish a structured approach for soliciting projects through well developed communications channels within the agency. Those agencies which have well structured energy conservation programs that could benefit from increased direct appropriations would not need to rely heavily on a centralized fund. Field staff at those agencies are continually made aware of the funding through internal agency announcements. The agencies can also identify their funding needs in the budget development process. One disadvantage is that the energy and water conservation needs of the agency are usually subordinated to other budget needs of the agency and generally do not receive adequate funding to support all cost effective project needs. Several agencies lack the well organized energy management programs needed to ensure adequate energy conservation funding from year to year. Such agencies can benefit from a centralized fund. A second disadvantage is that, in some cases, agency funds can be particularly narrow in focus, funding only project construction but not studies to identify worthy projects, or vice versa. This leads to inefficient allocation of some portion of the funding as projects with lower return on investment are funded because funding from another "pot of money" was not available to ensure the best projects were ready for funding. A third disadvantage is that many agencies do not need to establish a dedicated account or means of administering the funds or projects either due to the size of the agency or because the funds may be managed more cost effectively when spent through a broader capital equipment or operations and maintenance account.

One advantage of the centralized account is that it can cross agency lines to solicit and fund the best projects, ensuring that the limited resources provide the best return on investment. Another advantage is that the centralized account can have a broad focus in order to ensure that the variety of actions necessary to achieve the best projects can be funded. This broad focus can override many of the narrower rules and orders within the agencies which often hamper the efficient use of funds. When a centralized fund provides project funding using grants to agencies, as opposed to loans, the costs of administrative budgeting functions can be lowered. However, if the centralized fund were established as a revolving fund there would be a higher administrative cost to the government. A final advantage is that the centralized fund can be more flexible in allocation of funding to meet emerging needs. For example, an agency's budget request is started over one year before the funds will actually be received. This can result in a facility requesting and receiving funding for a project with the expectation of significant co-funding to be made by a utility demand side management program. With the rapid changes in the utility sector DSM programs, the utility contribution may not be available when the facility funding actually arrives. The facility or agency would then look for equal or better projects to fund. However, a centralized fund would have a wider array of options by looking at all the available projects within the Federal sector. The disadvantage is that the centralized fund will be less well known within the agencies without increased advertising expenses to reach the field staff.

The advantage of the combination of options, agency and centralized funds, is that the network for advertising the funding sources will be maintained within the agencies. The centralized fund also can act as a buffer or supplement to direct agency funding to stabilize the workload to match available agency resources and extend funding to an agency which has more conservation opportunities than it can complete with available funding. Since the centralized fund also can fund all necessary activities to ensure that the best projects are selected, it can ensure that those agency funds with a narrow focus can be directed toward the best projects. A centralized fund also can minimize funding shortfalls due to other competing and emergency agency budget priorities and can provide the flexibility and timely allocation of funds necessary to match emerging conservation opportunities. The disadvantage of a combination of agency and centralized funds is the slight increase in administrative overhead of managing a centralized account along with the costs of maintaining individual agency accounts.

Cost of Not Making Capital Available

The cost of having insufficient capital available to take advantage of all energy and water conservation opportunities far outweighs any other cost consideration. For example, ignoring the effect of discount rates, for each year that adequate capital is not available to accomplish a project with a three year payback, one year of savings from the project is lost. Those savings are roughly equal to 30 percent of the capital required to accomplish the project. In essence, the cost of not having capital available to accomplish such a project is 30 percent of the investment required. In simplistic terms, the cost of not having capital available for projects with a ten year payback is 10 percent for every year that the project is delayed.

These costs due to lost savings are a real expense as surely as interest charges are a necessary expense of making the capital available. Since the Army REEP study found that the average discounted payback period for most projects was approximately 4.5 years, it can be simply estimated that the cost of a one year delay for projects would be on average about 22 percent of the total investment cost. Since this value far exceeds the highest cost of capital that would be seen even in the private sector, it is obvious that the cost of delaying projects due to insufficient capital creates far more expense than would the cost of funding projects with more expensive capital.

On a Federal wide basis, the cost of delays in funding projects is equal to the annual savings that are not achieved due to a lack of funding. Again, extrapolating the Army REEP analysis to the remainder of the Federal sector indicates annual energy cost reductions of approximately $1.0 billion per year are yet to be achieved. This would indicate that the cost of insufficient capital is approaching $1.0 billion a year in lost savings. While it is not practical to immediately increase Federal funding to the estimated $5.7 billion level necessary to accomplish all projects and achieve these cost reductions, a significant increase appears to be warranted, even at the higher costs of capital available from non-federal funding sources.

Having insufficient capital available has the greatest impact on achieving energy, water and cost savings.

Capitalizing the Fund

The greatest challenge to establishing any funding mechanism is finding a way to build up the initial capital in the fund. This capital can then be used to fund individual energy efficiency and water conservation projects.

There are many options for capitalizing such government funds. The principal considerations in choosing these options are:

- the cost of capital;
- the use of non-Federal funds;
- fund replenishment; and,
- minimizing administrative costs and maximizing cost savings.

Contributing to the complexity of these issues are the various alternatives of using revolving funds, direct appropriations or a combination of the two. Each has a bearing on the fund's ability to act as a vehicle to achieve the energy performance requirement of NECPA and Executive Order 12902.

Cost of Capital: The cost of capital has a direct effect on the cost effectiveness of energy and water conservation projects. The more expensive the capital, the more expensive the project and the more likely it is that some number of projects will be eliminated from consideration because they do not meet the payback criteria established in NECPA. Conversely, low cost capital means more projects will be cost effective and will be accomplished, thereby generating more energy, water and cost savings.

The lowest cost of capital for any fund would be achieved by use of Government appropriations. Appropriations provide financing at the Government borrowing rate. Current borrowing costs are in the four to seven percent range.

If non-Federal sources of funding were used to finance projects through energy savings performance contracts, the cost of capital would likely be closer to the commercial market rates for funds, which is generally a few percentage points above the Government rate. There may be opportunities to lower the cost of capital due to improved investor confidence, by establishing a secondary market for energy efficiency financing. However, even with such a market in place, privately financed projects are likely to experience a cost of capital above the Government rate.

The Use of Non-Federal Funds: As stated above, the interest costs of using non-Federal funds are greater than the interest costs associated with using Federal funds. However, in the absence of full Federal funding to take advantage of all energy and water conservation opportunities, the use of non-Federal funds to finance conservation measures can be much less expensive than delaying projects until the Federal funds become available. This fact supports the use of non-Federal funding in Energy Savings Performance Contracting where a contractor finances, acquires, installs, and maintains the energy saving equipment.

Another possible means of using non-Federal funding could include the use of private funding strictly to finance Federal projects. This approach, which would require new legislation, would differ from energy savings performance contracting in that this alternative approach might allow agencies to borrow funds from non-Federal sources for the very limited purpose of financing cost effective energy and water conservation projects. The agency would be responsible for the procurement, installation, operation, and maintenance of the equipment. The agency would also be responsible for repayment of the loan. This repayment would come from appropriations to the agency but the loan repayment amounts would be offset by lower utility costs.

In formulating such an approach, a variety of issues would need to be considered. These would include: the conditions under which an agency would be allowed to borrow funds; the centralization of borrowing on behalf of the Government; limitations on the amounts and rates at which funds would be borrowed; and the mechanism for administering such an approach. The Department of Energy is currently reviewing the successful use of this model by several state and local governments. Any such alternative would clearly represent a substantial change in the Federal budgeting process and would require careful consideration of the complexities discussed below.

Fund Replenishment: A conventional appropriations or grant approach does not contribute to the replenishment of fund capital resources because it does not have to be paid back. In this case, the fund would need to be replenished each fiscal year by additional appropriations.

While a revolving fund may appear to solve the need for annual appropriations, in fact, it will simply be replenished by appropriated funds from the agencies appropriations for operations or utility accounts. Therefore, there is minimal impact on the level of Federal appropriations required. For example, with conventional appropriations, an agency may seek $50 million to accomplish proposed energy conservation projects. Once appropriated, the agency would accomplish the projects and no further budget action would be required. With a revolving fund, the fund would seek appropriations for a particular year. An agency could then use $50 million from the fund, accomplish the projects, and over the next several fiscal years would seek appropriations to repay the fund. The agency's appropriation requests would be more than offset by lower requests for utility accounts but appropriations would still be necessary to repay the loan. To ensure that the loans in any particular year did not become excessive when taken in the context of all other budget pressures, Congress would likely set a yearly limit on the amount of money that could be borrowed. In essence this yearly limit on loan amounts is comparable to the annual limits on appropriations to all agencies for energy and water conservation projects. In addition, the annual appropriations to agencies to repay the loans is similar to the yearly appropriations of amounts to individual agencies to complete projects.

Revolving funds which are offset by revenues derived from other federal funding sources provide the flexibility to fund unstable expenditures associated with providing a product or service such as the manufacture of defense consumables. A revolving fund for energy and water conservation could stabilize the variable appropriations stream for funding energy and water conservation measures. However, unlike other revolving funds, it could also reduce the expenses associated with providing the government products and services. The stabilization of the variable appropriations stream would allow agencies to plan with greater certainty the execution of their work on a more timely basis by being able to request funds when resources were available to complete the projects. However the stability of the revolving fund would only occur if the authorized limits to the amount of borrowing from the fund were stable from year to year. The current annual appropriations approach tends to cause uneven workloads throughout the year and from year to year. Authorization limits on the amount of borrowing from a revolving fund that varied from year to year would also cause uneven workloads throughout the year and from year to year.

Another advantage of the revolving fund approach is that the fund could make loans to those agencies which have the greatest opportunity for savings and rapid repayment. This would cycle the funds through the revolving fund more quickly than if each agency attempted to expend appropriated funds on only the best projects within the agency. More rapid cycling of the funds would lower the overall cost to the Federal government of not having adequate funds available within any agency.

In summary, the use of a centralized revolving fund can replenish the capital in the fund and thereby ensure funding for additional energy, water, and cost savings projects.

However, constraints placed on the operation of Federal revolving funds, such as caps on the amount to be loaned, could leave the fund under-capitalized and generate a significant expense in lost energy, water, and cost savings.

Minimizing Administrative Costs and Maximizing Cost Savings: The greater administrative/overhead cost of a revolving loan program is one of the disadvantages of such an approach. For example, the Federal Energy Efficiency Fund, which operated as a grant program, was run by one Federal employee with some contract assistance. With a revolving loan fund, each agency that received a loan would be required to track the loan repayment in a budget office through several years until fully repaid. This would increase the burden and costs on the agencies beyond that found in a grant program like the Federal Energy Efficiency Fund. For that reason, the direct appropriations approach minimizes the cost of administering the budgeting of energy and water conservation projects.

The best way to maximize cost savings is to ensure that funding is available to accomplish all energy and water conservation projects as soon as resources are available to support the workload. This requires that funding be applied to the correct budget accounts to support the study, design, procurement, construction or retrofit of any project which is cost effective. Adequate direct appropriations to agencies and a centralized account which can supplement direct appropriations as the needs for funds become available can solve the problem of providing funding when the resources are available. In addition, if the restrictions on the use of the funds are kept to a minimum, and performance of the funded portfolio of projects is used as a measure of success, then a central fund can meet the needs of supporting the different budget accounts such as studies, design, projects, etc. Therefore, a combination of direct appropriations and a centralized account which can fund the best energy and water conservation projects, or activities which lead to successful projects, can maximize the energy, water and cost savings when compared to a variety of separately funded agency accounts which are saddled with spending limitations and compete for funds against other budget priorities.

In addition to projects which result in energy efficiency or water conservation improvements, there are related energy and water projects which, while not improving the efficiency of the resource use, can reduce costs. An example is the use of thermal energy storage which shifts the energy use for air conditioning from times of peak demand and expensive rates to times of lower rates. Although no energy is saved, and in some cases, more energy is used, the cost savings far outweigh the increased energy use. While not satisfying the requirements of NECPA or the Executive Order, it is recommended that these projects be funded under any approved funding mechanism for their value in reducing the cost of government operations.

Summary of Findings

Based upon the discussion above, the Department of Energy finds that:

The funding requirements and likely sources of funds available to achieve the NECPA and Executive Order energy and water savings from 1996 through 2005 are shown in the following table:

Investment and Funding Totals from 1996 to 2005 (in billions)

Investment Needs		Range			
	Best Estimate	High-End Investment		Low-End Investment	
Energy Investment	$4.6	$5.5		$3.7	
Water Investment	$1.1	$1.6		$ .7	
Total	$5.7	$7.1		$4.4	
Expected Sources of Funding					
	Best Estimate	Low-End Funding	High-End Funding	Low-End Funding	High-End Funding
Direct Agency Appropriations	$2.4	$1.4	$2.8	$1.4	$2.8
Energy Performance Contracts	$ .9	$ .3	$1.2	$ .3	$1.2
Utility Demand Side Management	$ .4	$ .1	$ .5	$ .1	$ .5
Total	$3.7	$1.8	$4.5	$1.8	$4.5
Shortfall	$2.0	$5.3	$2.6	$2.7	$0.0

The Department of Energy also finds that:

The cost of not having sufficient funds available to achieve all cost effective energy and water conservation opportunities in the Federal building sector is on the order of $ 1.0 billion per year in excessive energy costs;

Agencies which have well-established energy and water conservation programs will benefit most from receiving a majority of funding by direct appropriations to the agency;

A centralized fund can be most effective by providing supplementary funds, as needed, to agencies that have well established and substantially funded energy and water conservation programs, as well as providing a dedicated source of funds for use by agencies which do not have well.established energy and water conservation programs;

The use of a combination of direct appropriations to agencies and to a centralized fund can increase the energy and water cost savings compared to the use of only direct appropriations to agency accounts;

The use of a revolving fund will increase the administrative costs of providing funds for energy and water conservation projects compared to direct appropriations;

The use of a revolving fund may not ensure a stable funding source for energy and water conservation since revolving funds will likely be subject to the potential destabilizing effects of limits on annual authorizations as a means of controlling spending authority, in a manner similar to current limits on direct appropriations for energy or water conservation projects;

The use of higher cost, non-Federal funds for energy savings performance contracts is generally less expensive than delaying energy conservation projects until lower cost Federal funds become available;

The authority to enter into performance contracts to achieve water or water cost savings, without saving energy, does not currently exist and, if authorized could increase the potential investment of non-Federal funds; and

The use of non-Federal funds to finance energy and water cost saving projects which could be accomplished by methods other than energy savings performance contracts is being studied as a means of supplementing any shortfalls in Federal funding and providing a stable long term source of funding.

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Appendix A

The Economics of Energy Efficiency and Water Conservation Investments

The discussion of the results of the Army REEP analysis and water conservation investments includes many of the important elements of the economics of efficiency investments. Key factors discussed include:

- the energy savings goals;
- the investment cost to achieve the goals;
- the rate at which the project delivers the cost savings;
- the number of years a project will continue to return savings; and,
- the total cost savings in future energy bills.

In addition to these factors are the underlying economic factors of the economy including:

- the interest rate at which funds are borrowed to make the investments; and,
- the future escalation of the prices of energy and construction costs.

Use of these factors can form the fundamental relationships of any energy project. These relationships are defined by such terms as simple payback period, discounted payback period, savings to investment ratio and return on investment.

Using a simple example, of an inefficient electric motor being replaced by an efficient motor, the following conditions will illustrate the relationships.

- -- The original motor used 20,000 kilowatt hours per year of electricity.
- -- The new motor is 10 percent more efficient and will consume only 18,000 kilowatt hours per year of electricity.
- -- The savings will be 2,000 kilowatt hours per year of electricity.
- -- The new motor will deliver savings for 15 years before an investment in another new motor will be required.
- -- The investment cost for the new motor is $450 more than the old motor.
- -- The current cost of electricity is 5 cents per kilowatt hour.
- -- Electricity costs are expected to stay stable at 5 cents per kilowatt hour into the future.
- -- Borrowing rates to make the investment are 8 percent per year.

The calculation of the economics would yield the following:

- -- The total investment increase for the motor is $450.
- -- The energy cost savings per year is: 2000 kilowatt hours X 5 cents per kilowatt hour, for a total of $100 per year.
- -- The simple payback for this investment is: $450 invested / $100 saved per year, for a simple payback of 4.5 years for the original investment.
- -- Over the 15 year life of the motor investment, a total cost savings of 15 years X $100 per year, or $1500 would result.
- -- The savings to investment ratio would be: $1500 / $450, for a total of 3.33 This is also called the non-discounted return on investment. The net savings would be $1050 for this project.
- -- When the borrowing rate is factored in to reduce, or discount, the value of dollar savings in later years, the total value of savings over the life of the motor investment approaches $900 instead of $1500. (In essence, the 8 percent borrowing rate means that the savings delivered in each future year are worth 8 percent less that the preceding year.)
- -- With a total discounted savings of nearly $900, the discounted savings to investment ratio is $900 / $450 or 2.0. This is also called the discounted return on investment of the project. The net discounted savings would be $450 for this project.
- -- When the borrowing rate is factored into the payback calculation, the pay back period becomes slightly longer. In this case it takes 5.3 years to pay back the investment so the discounted payback period is 5.3 years.

Q7.3 In the case of retrofits, please explain how that will be at "no cost to taxpayers."

A7.3 In the past, the government relied upon direct appropriations to finance energy retrofits. Now alternative financing mechanisms to pay for the cost of energy improvements are available. An alternative method is ESPC which is a public/private sector partnership whereby a private sector energy service company finances the up-front cost of purchasing and installing new energy efficient equipment, guarantees the savings, and the government repays the energy service company out of the resulting savings over the life of the contract.

Cutting Greenhouse Gases through Energy Savings Performance Contracts (ESPCs)

Q8. The July 25, 1998 Presidential Memorandum on "Cutting Greenhouse Gases through Energy Savings Performance Contracts" (ESPCs), directs "all Federal agencies to maximize use of this authority [i.e., the contracting provisions of Section 801 of the National Energy Conservation Policy Act, as amended by the Energy Policy Act of 1992] by the year 2000, when the authority expires . . . [and] "the Department of Energy (DOE) to lead an interagency effort to develop a legislative proposal extending ESPC authority past the year 2000."

It addition, the Memorandum states that the President has "asked the Office of Management and Budget [OMB] to provide new guidance to agencies that will help remove barriers and provide more incentives for using ESPCs. This guidance will change the budgetary treatment of these contracts to be consistent with the unique statutory authority for ESPCs. Specifically, the full amount of budget authority for the contract will no longer be needed up front, but can be made available over a number of years. In addition, this guidance will encourage agencies to permit up to 50 percent of the energy savings from ESPCs to remain at the facility or site where they occur. Both of these policies will help motivate Federal energy managers to make greater use of ESPCs and reduce agency operating costs."

Q8.1 Please explain the extent of the use of the Section 801 contracting authority since the enactment of the Energy Policy Act of 1992, and identify any problems with such use.

A8.1 Since the late eighties, 61 energy savings contracts have been awarded. These projects were carried out using a conventional contracting approach where each facility undertook its own contracting. In order to expedite the contracting process, DOE and DOD implemented plans to put regional contracts in place that all agencies can use. These contracts, known as Super ESPCs and regional awards, allow all Federal agencies and facilities to place delivery orders under an umbrella contract in order to undertake individual improvement projects. Agencies can select contractors through a more streamlined process, given that a smaller number of qualified suppliers and providers have already been chosen through a competitive process. These contractors are authorized to perform work at specific locations or regions. Given the new competitive contract mechanisms and the streamlined process, demands on agency resources to develop and award contracts should be greatly reduced and energy savings should be realized more quickly.

The initial ESPCs took two to three years to award. With the Super ESPCs in place and valuable lessons learned from the past, agencies should be able to omplement cost-saving projects in six to eight months.

Q8.2 Please explain how the President's directive conforms with Section 801, particularly with respect to his changing the requirement of needing the full amount of budget authority for an ESPC up front.

A8.2 Please see the answer to Q8.3.

Q8.3 Please identify the "barriers" that the OMB guidance is to "remove", and explain how this will be done.

A8.3 Prior to the issuance of OMB Memorandum 98-13 on Federal Use of Energy Savings and Performance Contracting (ESPC), it was unclear to most agencies that obligations, budget authority, and outlays could be recognized on an annual basis. The OMB Memorandum clarifies that as long as an agency has sufficient discretionary budgetary resources to complete the first year's contract costs, it may use ESPC authority.

Q8.4 What are OMB's new "incentives for using ESPCs"?

A8.4 The fact that OMB is asking agencies to increase their use of ESPC and to report semi-annually on task orders they have entered into during the year, because agencies' use of the ESPC authority has been below anticipated levels, should be an incentive for agencies to move forward with implementation. In addition, the OMB Memorandum highlights the Departments of Defense and Energy's efforts to streamline the contacting process by developing regional ESPC multiple award contracts that are available for use by all agencies.

Q8.5 Why is OMB, rather than the Secretary of Energy—with the concurrence of the Federal Acquisition Regulatory Council established under section 25(a) of the Office of Federal Procurement Policy Act—per Section 155(b) of the Energy Policy Act of 1992, involved in establishing new guidance?

A8.5 ESPC guidance was developed by the Department of Energy in concurrence with the FAR Council and published in final on April 10, 1995. The recent guidance, OMB Memorandum 98-13, was published on July 28, 1998 to increase agencies' use of existing ESPC authority.

Q8.6 Please provide a copy of this OMB guidance and explain if it will be subject to public review.

A8.6 A copy of OMB Memorandum 98-13 is attached. Because the intended purpose of the memo is to increase Federal use of ESPC in order to improve Federal energy management, using existing regulatory guidance, it was not subject to public review.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

THE DIRECTOR

July 25, 1998

M-98-13

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND ESTABLISHMENTS

FROM: Jacob J. Lew
Acting Director

SUBJECT: Federal Use of Energy Savings Performance Contracting

PURPOSE: To increase Federal use of Energy Savings Performance Contracting (ESPC) in order to improve Federal energy management; and to provide guidance for developing and entering into these contracts.

BACKGROUND: ESPC is a technique to reduce energy costs and consumption at Federal facilities, without increasing budgetary outlays. Energy Savings Performance Contracts are awarded to private firms to reduce energy consumption in Federal facilities and guarantee savings. Additional benefits of ESPC can include new capital equipment, reduced maintenance costs, improved indoor environments and reduced pollution. Contractors, using private investment capital, design, purchase, install and maintain energy efficiency improvement projects at a facility. Contractors then receive a negotiated share of the value of the energy savings generated by their efforts, and since the contractor is required to guarantee the savings, payment is made only if actual savings result from reduced energy use. When a contractor is fully paid its negotiated share of the delivered energy savings, all additional savings accrue to the government.

On October 22, 1997, President Clinton announced proposals for the Climate Change Technology Initiative which included immediate actions that the United States would take. One of these was to affect Federal energy management by expanding the use of ESPC — using private investment capital and expertise to accomplish energy and cost saving projects in Federal facilities. The Departments of Defense (DOD) and Energy (DOE) have streamlined the contracting process by putting in place regional ESPC multiple award contracts, which are beginning to speed large investments in energy projects and are available for use by any agency. However, Federal agencies' use of ESPC authority has been below anticipated levels. This memorandum is intended to encourage increased use of ESPC and improve Federal energy management.

Both the Energy Policy Act of 1992 (EPACT, *P.L.102-486*) and Executive Order 12902, *Energy Efficiency and Water Conservation at Federal Facilities* contain requirements for Federal energy management and establish energy reduction goals. EPACT requires agencies to install energy conservation measures with payback periods of less than 10 years and to reduce energy consumption levels by 20 percent relative to 1985 levels by the year 2000. Executive Order

12902 requires comprehensive facility audits to be conducted and establishes a 30 percent energy reduction goal by 2005. Facility audits cover the size, type, energy use and performance of all energy-using systems, appropriate conservation maintenance and operating procedures, recommendations for installing conservation measures, and a strategy to implement the recommendations.

To help agencies meet the EPACT and Executive Order requirements, section 155 of EPACT authorizes and the Executive Order encourages ESPC as a means of alternative financing. Agencies are requested to review their facility audits and determine the appropriateness of ESPC for projects that exceed current fiscal year funding capabilities or that can be combined with expensive or long term payback projects for faster implementation and generation of savings.

GUIDANCE: Agencies are encouraged to use ESPC to achieve significant long-term energy and financial savings in their operations. Government-wide regulatory guidance on ESPC is contained at 10 CFR 436. In addition, the Department of Energy's Federal Energy Management Program (FEMP) is available to provide assistance on facility audit reviews, investment decisions, technical issues, or general guidance on using ESPC. FEMP can be reached at (202) 586-5772. Additionally, the Defense Energy Support Center at Fort Belvoir, Virginia, and the U.S. Army Corps of Engineers, Engineering and Support Center, Huntsville, Alabama, can also offer ESPC support. They can be reached at (703) 767-8572 and (256) 895-1531, respectively.

The law authorizes agencies to enter into competitive, multi-year ESPC as long as funds are available and adequate for payment of the first fiscal year costs. Outyear costs or potential cancellation charges are not required to be financed up front. The statute also permits ESPC for a period of up to 25 years; but, requires a 30-day advance Congressional notification for any contract containing a cancellation ceiling in excess of $750,000. Agencies will be asked to report to OMB on a semi annual basis those ESPCs and task orders they have entered into during the year.

Thorough analysis through a capital planning and budgeting or equally disciplined process should be conducted in advance of entering into all ESPC agreements. Agencies should be aware of the budgetary implications of using ESPC -- the fact that they are financing an investment and creating obligations for future year funding that could impact the future funding of other programs. When an agency is considering ESPC, the following issues should be considered as part of acquisition planning:

- **Most Appropriate Mechanism:** Agencies should determine whether an ESPC agreement is appropriate for the work required. Although ESPC can be a valuable tool for obtaining energy conservation investments in an expeditious manner, these contracts may not be appropriate for buildings or facilities where usage may be reduced considerably or where operations may be terminated. Alternatives to consider include use of appropriated funds and Demand Side Management/Area-Wide agreements with local utilities.

- **Competition and Contracting:** Competitive selection among qualified firms for ESPC work is important to ensure that the government is receiving the best value possible, in terms of the expected savings realized by the government, quality of the installed material and equipment, and risk. This may be accomplished with commercial style procedures such as streamlined evaluation of approaches received from multiple award contract holders, or other processes. The goal is to enable the government to obtain the best deal possible by encouraging vendors to exercise due diligence to investigate and solve an agency's particular energy use problems and by making cost-effective, merit-based selections.

- **Termination or Cancellation:** ESPC must specifically address the rights and obligations of each party in the case of a termination or cancellation. Recognizing that it may be necessary for the government to terminate or cancel an ESPC agreement, the contract should contain provisions for determining equitable adjustments if the agreement is terminated or canceled during the term of the contract. There may be circumstances where the government should terminate or cancel the agreement due to a deficiency in the contractor's performance. Such deficiencies may include not achieving the savings projected by the contractor in its proposal or violating security agreements where the contract requires system maintenance on a government installation.

- **Ownership Retention:** Agencies must also consider issues of ownership of energy saving investments (materials and equipment) the contractor installs in government buildings and facilities. Through appropriate contract clauses, agencies need to ensure that contractors and their lenders do not have the right to remove items, which could interrupt government operations if anticipated savings have not been realized. Ownership is especially important when the contractor uses third party financing that may subject the material or equipment to liens or other types of security interests. In such cases, the government must ensure that it has an interest paramount to any lien or other types of security interest.

- **Energy Costs and Savings:** ESPC agreements must contain a guarantee of minimum savings to be generated by improvements, which must cover the full cost of Federal investment for improvements, if any. Agencies should consider providing for adjustments due to significant changes in the price of energy. For example, electricity industry restructuring may cause a significant change in power rates which would impact energy cost savings without necessarily impacting actual energy usage.

BUDGET TREATMENT: Obligations, budget authority, and outlays will be recognized on an annual basis. There must be sufficient discretionary budgetary resources to complete the first fiscal year's contract costs. For each of the subsequent fiscal years, discretionary budget authority and outlays will be recognized annually to the extent that payments are made on the contract. It is expected that energy costs will be reduced, reflecting ESPC savings and retained savings. All budget authority and outlays associated with ESPC will be classified as discretionary and will be subject to the discretionary caps under the Balanced Budget Agreement (BBA).

RETENTION OF SAVINGS: All agencies have been granted statutory authority to retain half of the government's portion of ESPC savings generated (DOD and the General Services Administration (GSA) have specific retention authorities, and EPACT grants it to all other agencies). The Office of Management and Budget (OMB) encourages agencies to permit the retention of some or all of the savings at the facility or site where they occur in order to provide incentive for facility and site managers to undertake more Federal energy management initiatives and to offset other operation and maintenance costs.

COORDINATION AND REPORTING: Within 60 days, OMB will convene an interagency policy group to address Federal energy management initiatives, including the increased use of ESPC. This group, which will include both energy and procurement program officials, will convene to report on the status of agencies' efforts in response to this memo, address other energy policy concerns and help spread successful energy program efforts more quickly among agencies.

Also, in accordance with the National Energy Conservation and Policy Act (NECPA), EPACT, Executive Order 13031 on Alternative Fuel Vehicle Leadership, and guidance published in OMB Circular A-11, each agency is required to submit information on energy use and energy efficiency improvements to both OMB and FEMP. OMB and DOE are working to coordinate that data collection and minimize agencies' reporting burden, while still meeting the intent of the overall reporting requirements.

Potential Conflicts Between the Kyoto and Montreal Protocols

Q9. An article in the July 23, 1998 edition of the *Clean Air Report* points out that under the Montreal Protocol the Parties are developing "strategies for phasing out" some substances and have agreed on acceptable substitutes, such as hydrofluorocarbons (HFCs), to use in place of "harmful ozone-depleting" substances which are banned by the Protocol. However, HFCs are listed in Annex A of the Kyoto Protocol as one of the six greenhouse gases. The article explains that a Montreal Protocol working group (Group) wants to establish "formal consultations" with a similar panel under the Kyoto Protocol (which is not signed or ratified by the U.S. and has not entered into force) "to study the potential conflicts in implementation of the two treaties." The Group also wants "studies into alternatives for HFCs."

The Group asked its "Technical and Economic Assessment Panel (TEAP) to consult with a counterpart group on the Kyoto treaty." The article then states:

> **"The main concern, sources say, is that multilateral efforts to fund conversion projects that allow manufacturers to use HFCs in place of CFCs will be counter-productive and will waste resources because HFCs may have to be controlled in order to meet the goals of the Kyoto treaty, according sources who attended the meeting. HFCs are widely used in the United States as refrigerants. HFCs are also used in other industrialized nations and environmentalists are concerned that expanding their use even more could hamper future climate change control efforts.**
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> * * * *
>
> **"A representative of the United States noted that the proposed TEAP study is premature because no efforts to control HFCs under the Kyoto treaty have occurred.**
>
> **"An EPA source says that the TEAP study may not be needed because it is not clear whether HFCs will need to be controlled as a greenhouse gas even if the Kyoto treaty is ratified. The source says that the Kyoto treaty calls for certain target levels to be met but does not specify which of the six greenhouse gases should be controlled. That is left up to the discretion of the nations and it may be possible to meet the targets by controlling gases other than HFCs.**

> **"Despite the slow start to the proposal, some environmentalists are still calling it a 'breakthrough worth noting' toward resolving any potential conflicts between the two treaties. One environmentalist notes that the proposal may change the pattern of managing the two treaties completely separately. The source, who is watching the negotiations closely, says that it may be more than year before specific strategies for formal consultation between the two treaties are developed."**

Q9.1 What are these alleged "potential conflicts," if any, between the two treaties?

A9.1 A possible "potential conflict," generally speaking, the *Clean Air Report* author might be alluding to, between the objective of the Montreal Protocol, arresting ozone layer damage, and the objective of the Kyoto Protocol which is not in force, mitigating the effects of global climate change, could be the impact which one Protocol's activities might bear on the work of the other Protocol. Specifically, using HFCs as an example, HFCs are effective non-ozone-depleting alternatives to CFCs. Yet, science has established that HFCs have a large global warming potential—although considerably less than CFCs global warming potential. A consultation between scientists and technical experts who aid Parties to the respective Protocols (assuming the Kyoto Protocol is in effect for purposes of discussion) could review the synergy of ozone-depleting substances and greenhouse gases in order that whatever future steps are necessary for atmospheric protection, the steps taken by the different Protocols would be complementary and harmonious.

Although neither Protocol has any provision to control the use or consumption of HFCs, given the growing use of HFCs, if the Kyoto Protocol were in effect, at some point in the future it is conceivable that Parties to the Kyoto Protocol might discuss what steps might be necessary beyond the identification of HFCs—and the other five greenhouse gases—a Party could choose to meet its emission targets. With a more formalized sharing of scientific and technical information between experts who have been focusing on discrete segments of atmospheric phenomena, the Protocol's objectives could be pursued complementarily without any hypothetical possible future conflict.

9.2 Why is it necessary, or even desirable, to establish such "formal consultations" under the two Protocols, particularly since the Kyoto Protocol does not require any Party to control all or any particular Annex A gas?

9.2 It is not necessary, strictly speaking, but I believe very desirable, for efficiency's sake at the very least, for there to be put in place a no or low-cost "bridge"—a formalized consultative/discussion mechanism—to harmonize the atmospheric protection objectives of the Montreal Protocol and the UN Framework Convention on Climate Change, or the Kyoto Protocol, were it to come into force and the United State were a Party. Such a contemplated consultative link, and the merits of it, in no way foretells discussion of control measures for HFCs or any other greenhouse gas (Kyoto Protocol Annex A gases) or other chemicals.

9.3 Could such consultations be established before the Kyoto Protocol enters into force?

9.3 As a matter of substance, we do not see a conflict between the two treaties. Nothing in the Kyoto Protocol mandates control or reduction of HFCs in particular; rather a Party could choose to regulate other greenhouse gases within the six-gas basket.

In terms of the "consultation" issue, while expert bodies under two treaties might theoretically "consult," it is more common that the secretariats of two treaties are asked by the Parties to the respective treaties to consult about an issue of common concern (e.g., consultations between the secretariats of the Basel Convention and the International Maritime Organization regarding issues of maritime transport of hazardous waste). This is a very frequent occurrence in the world of environmental and related treaties. Of course, the secretariats of various treaties have no authority to take any decisions pursuant to such consultations; any such decisions must be made by the Parties to the relevant treaties.

9.4 Please provide examples of other environmental and energy protocols or treaties where such a consultation process has been established, explain how such consultation processes work, and how effective and successful they are.

9.4 Please see the response to Q9.3.

Intergovernmental Panel of Climate Change

IPCC Proposed Rules Changes

Q1. Should the IPCC consider proposed chances in its rules before it considers the Chairman's proposals regarding the Synthesis Report?

A1. At the 14th Plenary (in Vienna, September 28 - October 3, 1998) the IPCC embarked in earnest on its Third Assessment Report on Climate Change, which the IPCC expects to complete in 2001. In this effort, the IPCC and its U.S. Chairman are seeking to produce the best, most objective scientific assessment possible. They are also seeking to ensure that the IPCC's scientific assessment is relevant to the questions and concerns being raised by policymakers around the world. If not objective, the IPCC's scientific assessment will quickly be repudiated; if not relevant to policymakers, it will not provide an informed and authoritative scientific basis for policy decisions.

To carry out its Second Assessment Report, the IPCC adopted rules of procedure to help organize and structure the assessment process and to avoid *ad hoc* decisions. The rules of procedure were intended to facilitate and improve the scientific assessment effort.

As the IPCC embarks on its Third Assessment Report, it was reasonable and desirable for the IPCC to revisit its rules to decide whether the approach adopted to serve a previous assessment effort remains valid and should continue in the new one.

It is also reasonable and desirable for the IPCC to adopt an approach that best achieves its objectives of scientific objectivity and policy relevance. The U.S. position going into the XIVth Plenary discussions was that past practice and precedent would certainly be instructive, but neither should preclude the IPCC from adopting new approaches or procedures which may better serve to meet the IPCC's objectives.

Line-By-Line Approval of the Synthesis Report

Q2. Should the United States insist on line-by-line approval of the Synthesis Report?

A2. In his proposal for a new approach to the Synthesis Report, the IPCC Chairman urged that it consist of two parts—a short summary for policymakers and a longer underlying report. He suggested that the summary for policymakers be approved line-by-line by governments. He also suggested that the longer underlying report be submitted for acceptance by governments but not approved line-by-line.

The Chairman's proposal, much of which has already been agreed by the IPCC at its 13th Session (Maldives, September 1997) was an outgrowth of current practice in the IPCC. Under it, each of the IPCC's three working groups (i.e., Working Group I on Science, Working Group II on Impacts and Adaptation, and Working Group III on Mitigation) prepares a short summary for policymakers and a longer underlying report. The summaries for policymakers are approved line-by-line by governments. The longer underlying reports are submitted for acceptance by governments, but not line-by-line approval. The different status of these summaries for policymakers and the underlying reports is clearly indicated in the IPCC publications themselves.

The reason for this bifurcated approach—line-by-line government approval of the summaries for policymakers, but government acceptance of the underlying reports—is two-fold. First, the sheer volume of information (hundreds of pages) contained in the underlying reports makes it impossible for governments to approve that material line-by-line at a plenary meeting. Second, the individual chapters of the underlying reports are prepared by small drafting teams that consist of scientists and other experts. While the drafting team must take into account a vast number and range of written comments submitted first in an expert peer review process and later in a combined expert/government review process, the drafting teams are ultimately responsible for the content of their chapters. If dissatisfied, governments can express their views at working group meetings, differing views can be noted in the chapters themselves, and ultimately governments can refuse to accept the working group's underlying report. However, governments cannot compel the scientists and experts on the drafting team to alter their conclusions.

This approach reflects the dual nature of the IPCC itself, and the need to accommodate two kinds of concerns—the IPCC is a scientific and expert body, but it is also an intergovernmental body. On the one hand, the IPCC must strive for high standards of scientific integrity and objectivity; on the other hand, the IPCC must ensure that it has and maintains the confidence and support of governments in its work.

When he proposed a new approach to the Synthesis Report, the IPCC Chairman noted that the previous Synthesis Report of the Second Assessment Report was not a true synthesis but rather was largely a compilation of the three summaries for policymakers of the working group reports. As such, it added little to the information already contained in those summaries for policymakers, and was not as useful as it might have been in addressing the questions and concerns most relevant to policymakers.

Thus, the IPCC Chairman has urged (and governments have agreed) that the IPCC seek to identify a series of key policy questions early in the effort to prepare the Third Assessment Report. Those questions were to be considered by governments at the IPCC's 14th Plenary. The final list of questions will be provided to the authors of the IPCC Working Groups who will be encouraged to bear these questions in mind as they begin their assessment work. The Working Groups will be asked to include in their reports scientific and technical information that may bear on these key policy questions. To be clear, the working groups will address the full range of scientific and technical issues surrounding global climate change, but in addition they will bear in mind the key questions relevant to policymakers as they undertake their assessment work.

Once the working groups have completed their draft reports, a separate drafting team would begin work on the Synthesis Report. Under the Chairman's proposal, that drafting team would be selected by the IPCC Bureau and consist of the working group co-chairs, other members of the IPCC Bureau, and additional experts. The Synthesis Report would seek to address the scientific and technical aspects of the key policy questions previously identified by the IPCC. It would synthesize and integrate information already contained in the IPCC working group reports.

In considering the Chairman's proposal at the IPCC's 13th Plenary (September 1997 in the Maldives), the IPCC supported his effort to make the Synthesis Report more relevant to policymakers. At the same time, a number of governments expressed concern about how to ensure that the Synthesis Report would remain policy-neutral and avoid policy prescription, and some insisted that the only way to ensure this result would be to require line-by-line government approval.

Like others, the United States supported the efforts of the IPCC Chairman to make the Synthesis Report more relevant to policy-makers, and we also agreed that it should remain policy-neutral and avoid policy prescription. Consequently, the United States tabled an amendment to the Chairman's proposal. Under the U.S. proposal, the IPCC Plenary would consider and agree on the list of key policy-relevant questions prior to embarking on the Third Assessment Report, and this list of questions could only be modified thereafter with the approval of the IPCC Bureau. The IPCC largely agreed with this portion of the U.S. amendment, except that it decided that any changes in the list of key policy-relevant questions should be made only with the agreement of the full IPCC.

In addition, the United States proposed that the full IPCC Bureau (with representatives of some 28 countries, including the United States) serve as an editorial board with respect to the underlying portion of the Synthesis Report. In that capacity, the full IPCC Bureau would review all written comments on the draft submitted by experts and governments, consider how the drafting team proposed to deal with those comments, and determine whether the approach proposed by the drafting team responded adequately to the issues raised. If not, the Bureau would be authorized to attach a dissenting view.

In this way, the United States sought to support the objectives of the IPCC Chairman while providing greater assurance that the underlying portion of the Synthesis Report would be produced in a process that ensured its objectivity and integrity. Unfortunately, this portion of the amendment proposed by the United States did not win the acceptance of all participants at the IPCC's 13th Plenary. Thus, the issue of how the Synthesis Report would be approved (as well as the amendment proposed by the United States) remains on the IPCC's agenda for further consideration in Vienna.

Because line-by-line government approval of the underlying portion of the Synthesis Report envisioned by the IPCC Chairman at a plenary session is not realistic, we worked with the Panel to explore other ways to make the Synthesis Report more policy-relevant while providing governments sufficient assurance of its objectivity and integrity. As suggested in your letter, one alternative considered was to shorten the length of the Synthesis Report so that governments could approve it line-by-line at an IPCC plenary session, among other alternatives. For example, we considered that the IPCC Bureau might undertake line-by-line approval of the underlying report, which would subsequently be submitted to the full IPCC Plenary for its acceptance.

We entered the XIVth session open to approaches and alternatives to resolve concerns as you expressed in your letter, while still enabling the IPCC to make its Synthesis Report more relevant to policymakers.

U.S. Support of IPCC Chairman's Proposals for Changes in the IPCC's Approach to the Synthesis Support

Q3. Does the United States support the Chairman's proposals for changes in the IPCC's approach to the Synthesis Report which would have it address a broad range of policy-relevant questions, and why?

A3 Yes, as stated above, we support the Chairman's proposals for changes that would have the Synthesis Report address a broad range of policy-relevant questions. We agree that there is little value in having the IPCC prepare a summary of the summaries—a summary of the three summaries for policymakers of the working group reports. We see a clear need for the IPCC, as part of its full scientific and technical assessment of climate change, to prepare a report that is as relevant to the questions and concerns of policymakers as possible, consistent with the critical need for the IPCC to maintain its scientific integrity and objectivity.

Moreover, we consider the use of policy-relevant questions defined by governments prior to initiating the Third Assessment Report to be a useful organizing tool for presenting the material and information contained in the working group reports in a way likely to be more useful to policymakers. We agree, however, that the IPCC must remain policy-neutral, that the Synthesis Report should be based on information contained in the working group reports, and that the Synthesis Report should not introduce policy recommendations. In other words, we agree that the Synthesis Report should remain a scientific and technical document, and not a policy report.

Policy-Relevant Questions

Q4. What are those policy-relevant questions? Has the U.S. reviewed all of those questions and concurred in them? How? When?

A4. The IPCC asked the U.N. Framework Convention on Climate Change (UNFCCC), through its Subsidiary Body for Scientific and Technological Advice (SBSTA), to identify questions relevant to policymakers that should be considered by the IPCC in preparing its Third Assessment Report. The SBSTA held an informal meeting with the IPCC during its session in November 1997. Annex B of the Report of that session contains an appendix (Annex II, copy attached) that lists key policy issues identified by Parties during that informal meeting. The SBSTA thereafter invited Parties to submit to the UNFCCC secretariat before January 20, 1998, additional information on key policy issues to be addressed in the Third Assessment Report. Submissions received from Parties (the United

States made no written submission) were compiled and circulated prior the SBSTA session in June 1998 (copy attached). The list included in the SBSTA report of November 1997 together with the compilation of additional submissions from Parties have been provided to the IPCC for consideration by the IPCC at its 14th Plenary.

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NATIONS

Framework Convention
on Climate Change

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SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE

REPORT OF THE SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE ON THE WORK OF ITS SEVENTH SESSION

BONN, 20-28 OCTOBER 1997

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Annex II

List of key policy issues to be addressed in the Third Assessment Report of the Intergovernmental Panel on Climate Change

The issues listed below were identified by Parties during an informal meeting with the Intergovernmental Panel on Climate Change (IPCC), taking note of the fact that the list may not be exhaustive. Parties have been invited to submit to the secretariat, before 20 January 1998, additional information on key policy issues to be addressed in the Third Assessment Report (TAR).

1. General suggestions:

- Assess and narrow the range of uncertainties;
- Improve and simplify the presentation of results;
- Timely dissemination of reports in print and via electronic mail (where available);
- Translation of literature into, and utilization of literature in, languages other than English;
- Inclusion of an index in the TAR in order to facilitate its use;
- Improve assessment by narrowing the range of uncertainties and indicating the limitations of results;
- Present the results in such a way as to ensure the TAR remains advisory in nature.

2. Specific requests to the IPCC:

(a) To develop and improve existing scenarios, taking into account current technological developments and efforts of developing countries in response to climate change.

(b) To quantify the social, economic and environmental implications of :
- different stabilization pathways in all sectors;
- technologies and related costs, and the necessary policies needed to set limits of e.g. 2 °C, 20 cm sea level rise and a CO_2 concentration of 550 ppmv;
- changes in various indicators of climate change;
- different levels of greenhouse gas (GHG) concentrations, with a view to interpreting Article 2 of the Convention.

(c) To improve and update Global Warming Potentials (GWPs) in order to narrow the range of uncertainties.

(d) To assess the adequacy of land, ocean and satellite- based observational and monitoring systems.

(e) To develop and improve existing methodologies and guidelines to assess GHG sinks, and other gases not yet included in the IPCC assessment, such as nitrogen fluoride.

3. Policy- relevant questions:

(a) Would delaying action increase the risk of surprises, in particular in the form of rapid and/or irreversible changes to the climate system?

(b) With respect to equity-related issues:
- What are the linkages between historic emissions and future climate change?
- How can barriers be removed to facilitate the transfer of technologies between developed and developing countries?

(c) What are the technological options for adaptation, particularly low-cost options, for developing countries?

(d) What are the costs of action and inaction in response to climate change?

(e) What are the linkages between the El Niño phenomenon, changes in regional precipitation and extreme weather events, on the one hand, and global warming, on the other hand?

(f) What are the interactions between climate change and other environmental changes; what are their implications for policies responses; and what are the economic and social costs?

(g) What are the most common minority views which contradict the consensus of available scientific conclusions?

18 June 1997

CHINESE/ENGLISH ONLY

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
Sixth session
Bonn, 28 July - 5 August 1997
Item 5 of the provisional agenda

COOPERATION WITH RELEVANT INTERNATIONAL ORGANIZATIONS

Structure and content of the Third Assessment Report by the IPCC

Comments by Parties

Note by the secretariat

The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its fourth session, invited Parties to submit comments on the planned structure and content of the Third Assessment Report (TAR) to the secretariat, by 30 May 1997 (FCCC/SBSTA/1996/20, para. 25), for compilation into a miscellaneous document.

The secretariat has received four such submissions. In accordance with the procedures for miscellaneous documents, these submissions are attached and reproduced in the language in which they were received and without formal editing.

FCCC/SBSTA/1997/MISC.4
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Paper No. Page

1. China 3
(Submission received 15 May 1997)

CHINA'S COMMENTS ON THE PLANNED STRUCTURE AND CONTENT OF THE THIRD ASSESSMENT REPORT FROM THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

2. Egypt 5
(Submission received 12 June 1997)

COMMENTS ON THE DRAFT DISCUSSION PAPER ON THE IPCC THIRD ASSESSMENT REPORT

3. Netherlands 6
(on behalf of the European Community and its member States)
(Submission received 2 June 1997)

COMMENTS ON THE PLANNED STRUCTURE AND CONTENT OF THE THIRD ASSESSMENT REPORT

4. Switzerland 9
(Submission received 4 June 1997)

COMMENTS ON THE THIRD ASSESSMENT REPORT OF THE IPCC

PAPER NO. 1: CHINA

An electronic version of this text was not available

PAPER NO. 1: CHINA

(UNOFFICIAL TRANSLATION)

China's Comments on the Planned Structure and Content of the Third Assessment Report from the Intergovernmental Panel on Climate Change (IPCC)[1]

1. The Third Assessment Report of the IPCC should not simply follow the structure of the previous assessment reports. It should focus on new facts and findings which were not included in the last two reports, particularly on the progress that have been made in clearing up the uncertainties.

2. In assessing climate change and the impacts of human activities upon the climate system, the Third Assessment Report of the IPCC should reflect comprehensively different views and findings.

3. The Third Assessment Report of the IPCC should provide answers to the questions that are of concern to most developing countries, such as what adverse effects the policies and measures adopted by the developed countries may have upon the developing countries, what policies and steps the developed countries should take for the transfer of technology to the developing countries and how to achieve such transfer.

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[1] This submission has been retyped. The secretariat has made every effort to ensure the correct reproduction of the text as submitted.

PAPER NO. 2: EGYPT

Comments on the draft discussion paper on the IPCC Third Assessment Report [2]

1. No comments on the discussion paper concerning the structure of the working groups and the Evaluation framework as well as the contents of the Working group reports.

2. The second option on the Structure of the working groups is agreed. The first WG I should take care of the Science of Climate Change, while WG II should encompass Impacts and Adaptation including the social and economic aspects. WG III should encompass the mitigation options including social and economic aspects.

3. The proposals concerning the Composition of the Bureau are agreed.

4. Concerning Funding for Technical Support Units, there is a support for Option III that provides for the participation of one developing country professional to be financed from the IPCC Trust Fund.

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[2] This submission has been retyped. The secretariat has made every effort to ensure the correct reproduction of the text as submitted.

PAPER NO. 3: NETHERLANDS
(on behalf of the European Community and its member States)

Comments on the Planned Structure and Content of the Third Assessment Report

1. As requested in FCCC/SBSTA/1996/20 para.30 the EU would like to offer its comments on the planned structure and content of the Third Assessment Report (TAR) from the IPCC. The EU welcomes the proposals being put forward by the IPCC to prepare a third full assessment report on the scientific, technical and economic aspects of climate change. The EU would reiterate the importance it attaches to the work of the IPCC. In its view it will be essential for the IPCC to maintain its scientific credibility, its independence and impartiality. It welcomes proposals for the future of the IPCC and the Third Assessment put forward in the chairman-elect's discussion paper. In particular it welcomes proposals to broaden participation in the IPCC process by aiming for greater involvement of developing countries and experts from both the environmental and industrial NGOs.

2. With regard to the TAR the EU supports a broad review of the science, impacts adaptation and mitigation strategies, technology options and socio-economic issues as carried out in the 2nd Assessment Report. The structure is largely a matter for the IPCC but the EU would make the following observations: it would support option II on the structure of the TAR and would encourage an increased focus on the regional impact of climate and the greater integration of social economic aspects. It would also wish to see some assessment of the impact of policies and measures to mitigate and adapt to climate change as well as the impact of inaction. It would also be useful in furthering our understanding of global greenhouse gas processes to compare total emissions from developing and developed countries' inventories with emissions calculated from global flux cycles.

3. The EU would strongly support the preparation, in addition to the full three volume assessment, of an over-arching report synthesising the results of the assessment and answering key questions which are of relevance to the Parties to the Convention and the future Protocol, and dealing with cross-cutting issues not easily covered in the working group reports. In preparing a synthesis report the IPCC should consider working closely with the FCCC secretariat and invite some policy makers into working groups as advisors.

4. With regard to the contents of the synthesis report, the EU would like the IPCC inter alia to address the following questions:

- what further progress has been made in detection and attribution of climate change, both at a global and regional level.

- for a range of non-intervention scenarios for the future of all greenhouse gas emissions and sinks and aerosols, what are the resulting atmospheric concentrations of greenhouse gases and aerosols, the global and regional climatic changes and associated impacts.

- what policy intervention scenarios for emissions and sinks would be needed to stabilise greenhouse gas concentrations at a range of levels giving particular attention to CO stabilisation between 350 and 750 ppm.

- what are the impacts of climate change associated with each of these scenarios and with different stabilisation levels (noting that impacts may take longer to stabilise e.g. sea level rise, ice melt and ecosystem adjustments)?

- what possible combination of policies concerning all sources and sinks might be able to achieve stabilisation of greenhouse gas concentrations at different levels and for different constraints on rates of change.

- what are the technological, economic and equity implications of mitigation and adaptation policies or developed and developing countries at a regional level, for the intervention as well as for the non-intervention scenarios?

- where possible, identify the risk of "surprises" in particular in the form of rapid and or irreversible changes to the climate system.

- can thresholds for severe impacts, climate instability etc. be identified for different greenhouse gas concentrations and rates of change which might give some insight into consideration of dangerous levels of greenhouse gas concentrations?

- where is there significant interaction between climate change and other environmental changes and what are the implications for impacts, policy responses and economic and social costs?

5. The EU recognises that there are a number of very challenging questions which may not be easily or readily answered from the scientific and technical literature. To this end, it may be helpful if the IPCC makes widely known well in advance of the publication of the TAR those questions which it will be seeking to address, thus giving the scientists and economists time to consider such focused questions, carry out and publish research in time for the TAR.

6. Throughout the TAR in its presentation of material it would be helpful if the IPCC could do more to quantify uncertainties. Too often in the previous reports phrases have been added referring to uncertainties without providing an indication of the size of the uncertainties and what they imply. In particular it would be helpful if the sensitivity of the climate system

to a doubling of CO2 could be revisited. The range has stuck at 1.5°C to 4.5°C for sometime. The EU would like to see a full reassessment of this parameter as a ready indicator of the likely scale of climate change.

7. Regarding the timing of the TAR publication, the chairman elect has suggested mid-2001, 5 years after publication of the 2nd Assessment Report. The EU would strongly support this provided the report is completed by the end of 2000 and if possible earlier.

8. Finally the EU would like the Secretariat to convey its best wishes to the IPCC towards the preparation of the TAR, recognising that the voluntary efforts of many scientists worldwide will be called upon to provide the scientific expertise and impartiality for which IPCC is justifiably noted.

PAPER NO. 4: SWITZERLAND

Comments on the Third Assessment Report of the IPCC.
United Nations Framework Convention on Climate Change
Subsidiary Body for Scientific and Technical Advice (SBSTA)
Sixth session, 28 July - 5 August 1997, Bonn
Third Assessment Report of the IPCC

In response to the call at SBSTA 4 for comments concerning the planed structure and content of the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC), Switzerland presents the following views.

1. Objective of the TAR

The objective of the TAR should be to provide to all stakeholders, including policy makers and the scientific community, an assessment of the current knowledge on climate change. It should bring elements allowing to make progress in the determination of the "dangerous anthropogenic interference with the climate system". It should help in the process of implementing the Convention.

2. Overall structure of the TAR

The overall structure of the TAR should be analogous to that of the SAR. It should address the scientific, economic and social aspects of climate change relevant to the implementation of the Convention. The division of the TAR in three thematic groups, i.e. the science of climate change, impacts and adaptation, and mitigation, seems appropriate. Nevertheless, the IPCC should proceed to some minor changes in order to overcome limitations and overlaps of chapters noticed in the SAR.

3. The Synthesis Report

The TAR should comprise a Synthesis Report. This Synthesis Report should be a "true" synthesis of information contained within the three Working Groups (WG) reports. It should help all stakeholders to implement the Convention. The Synthesis Report should be a "self-generating" process. This means that when writing up summaries for policy makers, the relevant information for various aspects of the Convention should be extracted and presented in a short, separate document. Therefore, the structure and scope of the Synthesis Report should not be established prior to the initiation of the TAR or before the three WG reports are finalized.

4. TAR and Technical Reports

Innovative ways of improving the presentation of the TAR should be found in order to avoid difficulties when disseminating the findings of the TAR. The fact that the bodies of the Convention have asked for Technical Reports based on the SAR indicates that there is a need to present the information in a more userfriendly way.

5. Publication of the TAR

There are two issues related to the dissemination and availability of the IPCC works : the publication of the documents in all UN languages', and the dissemination of the findings of the IPCC.

The translation of the TAR into all UN languages', as well as that of all "approved/accepted" documents related to TAR which will be produced by the IPCC, should be assured. The IPCC, the Convention and the countries should provide financial means for these translations. In particular, countries should be invited to provide translation services as contributions in kind for the TAR.

The IPCC, the Convention and the countries should assure a broad diffusion of the TAR. The documents of the TAR should be made available to all stakeholders and the findings of the TAR should be disseminated through seminars, workshops and campaigns of information assuring a broad public awareness. The Secretariat of the IPCC should make all IPCC documents available on the Internet in a userfriendly way.

6. Timing of the TAR

Two aspects are important : the time needed by the authors and reviewers (peer and governmental) to produce a high quality work, and the time needed by Governments to understand the TAR and start implementing its findings.

The key to the success of the TAR will be its quality. This quality will depend on the time left to authors and reviewers to complete their work. Therefore, the TAR should not be approved/accepted before 2001.

Concerning the time needed by Governments to understand and start implementing the findings of the TAR, what is important is the effort on the part of the IPCC and other bodies, such as the Information Unit on Convention from UNEP, to present and to disseminate the findings of the TAR in a userfriendly way.

7. IPCC Bureau, Secretariat and TSUs

The current composition of its Bureau has allowed the IPCC to achieve important goals such as the completion of the SAR. Switzerland considers that a certain continuity in the composition of the Bureau would assure the quality of the work of the IPCC.

The Technical Supports Units (TSUs) help the co-chairs of the Working Groups in accomplishing their task. There should be a good co-ordination between the IPCC Secretariat and the TSUs. The Secretariat plays an essential role, assuring the coherence of the IPCC process. The TSUs should not act separately from the Secretariat. In the division of labour, they should serve as ancillary units of secretarial and support nature the work of which should be embedded in the

Secretariat's line of work and not acting separately from it. Duplication of work between the Secretariat of the IPCC and the TSUs should be avoided.

Innovative ways of improving the efficiency of both the Secretariat and the TSUs should be investigated, as e.g. reinforcing the staff capacity of the Secretariat. We wonder if the latter could not perform part of the current work of the TSUs in a more efficient way. It could also be envisaged to share the costs of the TSUs between two or three Annex I countries. Staff from non-Annex I countries may be included in the TSUs for capacity building purposes. In any case the establishment and financing of the TSUs should not constitute a condition for a country to become eligible as member of the Bureau of the IPCC.

9. Financial means

Countries should secure financial means to help the scientific community to take part in the elaboration of the TAR. Individual investigators should be supported and their scientific independence should be safeguarded.

10. Appreciation

Finally, Switzerland would like to thank again the Chairman of the IPCC, Professor Bert Bolin, and all the scientists who have contributed during years to assessing the understanding of climate change. We consider the elaboration of the SAR a major success of the IPCC. We are confident that the Third Assessment Report will be, at the time of its completion, the most comprehensive and authoritative work in the field of climate change. We extend all our good wishes to the Chairman elect Robert Watson who will have the responsibility to conduct this challenging task.

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8 April 1998

ENGLISH ONLY

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
Eighth session
Bonn, 2-12 June 1998
Item 3 of the provisional agenda

COOPERATION WITH RELEVANT INTERNATIONAL ORGANIZATIONS

Structure and contents of the Third Assessment Report by the IPCC

Additional comments by Parties

Note by the secretariat

1. At its sixth session, the Subsidiary Body for Scientific and Technological Advice (SBSTA), invited Parties to submit comments on the planned structure and content of the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC) to the secretariat, by 20 January 1998, for compilation into a miscellaneous document (FCCC/SBSTA/1997/6, para. 44). The secretariat has previously made submissions from Parties available which were received by 30 May 1997. These were compiled into document FCCC/SBSTA/1997/MISC.4.

2. The secretariat has received three such submissions.* In accordance with the procedures for miscellaneous documents, these submissions are attached and reproduced in the language in which they were received and without formal editing.

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* In order to make these submissions available on electronic systems, including the World Wide Web, these contributions have been electronically scanned and/or retyped. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

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PAPER NO. 1: ALLIANCE OF SMALL ISLANDS STATES (AOSIS)

AOSIS VIEWS ON THE WORK OF THE IPCC

AOSIS members wishes to express their sincere appreciation to the excellent work done to date by the IPCC and its Bureau. It noted with appreciation the information provided by the Chairman and the Chairman-elect at the present sessions of the Subsidiary Bodies to the UNFCCC, particularly regarding the Third Assessment Report (TAR). AOSIS gives its full support to the on-going and valuable work of the IPCC and re-iterates the need for the IPCC to continue to maintain its independent and non-political role in fulfilling its mandate.

On the financial contributions to the work of the IPCC, AOSIS wishes to thank parties that contributes to the IPCC Trust Fund which allowed experts from developing countries, including AOSIS experts, to participate in the work of the IPCC. AOSIS urges these Parties to continue to provide adequate funding to the Trust Fund to ensure the further involvement of experts from non-Annex Parties in the future work of the IPCC.

AOSIS requests that the IPCC, in carrying out its work, to cooperate closely with other international organizations such as the World Meteorological Program (WMO) involved in international research programs to advance our understanding of the climate system and its response to climate change. AOSIS gives its full support to the Climate Agenda program.

Regarding the TAR, AOSIS noted with satisfaction the regional emphasis on the report and the efforts by the IPCC to fully involved experts from non-Annex I country parties. AOSIS requests the IPCC to address the following issues in the TAR.

- The IPCC to further narrow down the remaining uncertainties in the IPCC projections and scenarios.

- The ranges used by the IPCC in past reports and papers are based on collective judgment of IPCC authors and reviewers of each chapters and papers. AOSIS sees the need for the IPCC to develop and draw formal methodologies to achieve more consistency in setting criteria for high and low range limits.

- On computer modeling, AOSIS requests the IPCC to put more efforts to narrow down grid box scales to smaller scales in order for these models to be meaningful and applicable to AOSIS members.

- Provision of accurate information and analysis on the effectiveness and implications of proposed PAMs to mitigate and adapt to climate change and sea level rise, in particular the socio-economic implications including losses incurred by implementing PAMs in Annex I parties.

– Put more efforts on assessment of regional impacts and responses to climate change and sea level rise particularly adaptation options. Of particular importance to AOSIS is the need to further improve our understanding of the role of the oceans in determining the response time of the climate system. In this regard, efforts gear towards further understanding regional weather patterns which have major influence on AOSIS members (e.g. El Nino Southern Oscillation, Tropical cyclones etc.) should be of high priority for the work of the IPCC.

– Structure of TAR could be improved. AOSIS expresses concerns on the structure of past papers and reports. It took a great deal of efforts to synthesize these into manageable sections.

PAPER NO. 2: AUSTRALIA

COMMENTS ON THE IPCC THIRD ASSESSMENT REPORT

A. General Comments

1. Presentationally, it would be extremely helpful if the TAR included a section/chapter which summarised the key advances, changes and developments since the second assessment report (SAR) of 1995. This would be particularly helpful to readers familiar with the SAR who want readily identifiable description of the extent to which the TAR included new information and makes different assessments.

2. The report could usefully include a section that covers the frequently asked questions/misinterpretations associated with previous IPCC findings.

3. Models - both scientific and econometric - will continue to play important roles as tools in making climate change assessments. The TAR should provide an updated assessment of the utility (and uncertainties) of such models, including integrated assessment models, ie what are the various models telling us now and how can they be improved.

4. The SAR assessments of the extent of "no regrets" mitigation opportunities should be refined with a focus less on technical potential and more on a realistic assessment of practical possibilities (and how to overcome barriers to implementing "no regrets" measures), including in developing countries. An assessment of newly emerging "no regrets" measures, as technologies develop and become more cost effective in terms of their greenhouse gas mitigation benefits, would also be valuable.

5. The assessment of the mitigation potential of technologies, practices and policies should consider the implications of the patterns of global production and trade in energy intensive goods.

B. Policy-relevant questions for the Synthesis Report

1. To what extent is it important to be able to distinguish between human induced greenhouse gas emissions and those from non-anthropogenic sources, given the different definitions of climate change employed by the IPCC and under the UNFCCC. Would a natural/anthropogenic emissions counting system be effective?

2. How does our understanding of the interactions of non-atmospheric features of the climate system (e.g. oceans, cryosphere) compare with that of the atmospheric aspects?

3. What progress has been made in determining the possible interactions of climate change with major causes of climatic variability such as the El Nino - Southern Oscillation?

4. What progress has been made in refining global warming potentials, to enable better accounting of emission reductions of greenhouse gases other than carbon dioxide?

5. What progress has been made in reducing uncertainties in the measurement of carbon sequestration/emissions through land use and forestry changes and other sectors of high measurements uncertainty?

6. How important is it to avoid rapid rates of warming?

7. What are the consequences of delaying emissions reduction action under various concentration profiles (concentration level and target year)? Can the economic costs and benefits of delay be quantified?

8. How can optimal emissions pathways be defined?

9. How does more comprehensive assessment of non-energy abatement options affect the assessment of costs and benefits?

10. How well does the assessment of abatement options deal with existing market imperfections (including subsidies - direct and indirect -, information failure, institutional inertia and imperfection, bounded rationality, social vs private discounting, non-greenhouse externalities, etc)? What analytic tools are available to assess policy options in the "real world"? How many of the available analytic tools deal with non-energy issues?

11. What is the likely magnitude of the so-called "rebound effect", where investments in energy efficiency are offset to some degree by resulting increase in output? How does analysis of the issue differ at the firm, industry, national and international level?

12. To what extent will the provisions of the FCCC and Kyoto Protocol affect, positively or negatively, the range of options identified for technologies, practices, policies and policy instruments to adapt to, or reduce, greenhouse gas emissions from sources and to enhance removals of greenhouse gases by sinks?

13. What are the implications for atmospheric concentration, climate and sea level of the proposed targets and timetables to reduce emissions contained in the Kyoto Protocol?

PAPER NO. 3: SRI LANKA

COMMENTS FROM SRI LANKA ON THE IPCC THIRD ASSESSMENT REPORT

1. Emissions Scenarios

The Assessment reports depends heavily on the five emissions scenarios IS92 a-e. All the estimates of mean temperature rise (MTR) and sea-level rise (SLR) are given corresponding to each of these scenarios. However, none of these scenarios is defined in the report. One has to go back to the 1992 Assessment Report (AR1) for their definitions. Since it occupies only one page (p of 1992 AR), I suggest that this page be reproduced in the AR3, if you are planning to use the same scenarios in the new report.

2. Mean Temperature Rise and Sea Level Rise Estimates

The MTR and SLR estimates for 2100 are given subject to two variables, one the emission scenarios and the other climate sensitivity. For each of these, there are 3 values, high, medium and low. Hence, the results could be presented in the form of a matrix as given below. The data given in the AR2, some of which had to be interpolated from the diagrams, cover only a few elements in the matrix. It might be at least of academic interest to give the balance elements in the matrix.

TEMPERATURE RISE IN °C

EMISSION SCENARIO	**CLIMATE SENSITIVITY**		
	Low	Medium	High
High		2.5	3.5
Medium		2	
Low	1	1.3	

SEA LEVEL RISE IN cm

EMISSION SCENARIO	**CLIMATE SENSITIVITY**		
	Low	Medium	High
High		55	95
Medium		50	
Low	15	38	

3. Climate Sensitivity

One of the variables used, namely climate sensitivity has been defined as the temperature rise in the atmosphere corresponding to doubling of the carbon dioxide concentration. This is denoted in the AR2 as ΔT and its unit is given as °C. Generally the term sensitivity is defined as the amount of response per unit measure of a stimulant. Here the stimulant is $2xCO_2$ and the response is the temperature rise. Hence the unit of sensitivity should be expressed as $°C/2xCO_2$. This will also remove the confusion that may arise by having the same unit °C for sensitivity as well as for the temperature rise as appearing in AR2. This is specially so because the sensitivity range (1.5 - 4.5 °C) is of the same order of magnitude as the temperature rise range.

4. Availability of Fossil Fuel

In fixing the emissions scenarios up to 2100, it has been assumed that there will not be any constrains on the supply of fossil fuels during the next century. However, other sources of data indicates that at the present rate of consumption, the economically recoverable deposits may not last that long. Hence, a brief clarification on this point may be desirable.

- - - - -

Synthesis Report

Q5. When will the Synthesis Report be prepared, be subject to review, and be released?

A5. The IPCC has not yet reached firm decisions on the manner in which the Synthesis Report will be prepared.. We understand that the IPCC intends to begin preparation of the Synthesis Report as soon as initial drafts of the working groups reports are completed, that the draft Synthesis Report (both the summary for policymakers and the underlying report) should be submitted for simultaneous expert and government review as soon as possible after the working group reports have been adopted, and that the Synthesis Report should be released as closely as possible to release of the working group reports, probably in mid- to late 2001. Because the Synthesis Report will synthesize and integrate information contained in the reports of the IPCC's three working groups, it is inevitable that there will be some delay between finalizing those working group reports and finalizing the Synthesis Report.

Q6. Will the Synthesis Report be prepared as part of the Third Assessment Report, and if not, what will be its purpose?

A6. Yes, the Synthesis Report will be prepared as part of the IPCC's Third Assessment Report.

Q7. Is the IPCC creating a new report that is separate from the assessment?

A7. No, because the Synthesis Report will synthesize and integrate information contained in the reports of the IPCC's three working groups it will necessarily be part of the IPCC's Third Assessment.

Designation of IPCC Rules of Procedure as "Guidelines"

Q8. Why are the IPCC Rules of Procedure proposed to be designated as "Guidelines", and does this change mean or imply that such "Guidelines" are not binding on the IPCC, its Chairman or the lead authors?

A8. As noted in the response to the first question above, the IPCC adopted rules of procedure to help organize and structure its scientific and technical assessment effort and to avoid *ad hoc* decisions. Once adopted, the IPCC (including its Chairman and the lead authors) seeks to follow its rules or guidelines so as to conduct its work in an orderly manner, to provide experts and governments sufficient time in which to review and comment on IPCC drafts, and to promote transparency.

First and foremost, however, the IPCC is a scientific assessment effort undertaken by over 2,000 of the world's pre-eminent scientists and experts, nearly all of whom contribute their time and expertise without compensation. The IPCC's rules or guidelines are designed to facilitate their work, not complicate it.

As we understand it, the proposed re-designation from IPCC Procedures to IPCC Guidelines is intended to indicate that, while such procedures are expected to be observed, insistence on meticulous compliance would be inappropriate given the massive scale and complexity of the IPCC assessment effort. Still, as noted, the IPCC has a strong interest in ensuring that its procedures are carefully observed because any material lapse inevitably invites criticism of the FPCC and can call its work into question. This interest is the same, whether the title is procedures or guidelines.

Q9. If the IPCC's Guidelines are binding, what does this proposed change in title mean or imply, and does the United States support this change?

A9. The United States supports the change because, as noted above, it has no practical significance with respect to the rights of parties or the integrity of the IPCC process. Further, the United States believes that technical or minor procedural irregularities that do not materially affect the integrity of the process should not be used to call into question the work produce of the IPCC.

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Vacancy

September 18, 1998

The Honorable Stuart E. Eizenstat
Under Secretary of State for Economic, Business
and Agricultural Affairs
U.S. Department of State
2201 C Street, NW
Washington, DC 20520

Dear Under Secretary Eizenstat:

Since I last submitted questions to you on August 7, 1998, which are yet unanswered, about Kyoto Protocol and Intergovernmental Panel on Climate Change (IPCC) matters, my staff received from the IPCC two new documents for the fourteenth session of the IPCC and its Working Groups that begins later this month. Both documents raise serious concerns.

The first document [IPCC-XIV/Doc. 5 (25-VIII-1998)], submitted by the Chairman of the "Ad-Hoc Group on Procedures," is entitled:

> "Proposed Amendments To The Principles Governing IPCC Work And Procedures For The Preparation, Review, Acceptance, Approval And Publication Of IPCC Reports."

It contains a 2-page "Principles Governing IPCC Work" and a 15 page Appendix with two Annexes. The cover page of the appendix calls it the "Procedures for the Preparation, Review, Acceptance, Approval and Publication of IPCC Reports," which, I understand include the Third Assessment Report scheduled for the year 2000. However, the heading of Appendix proposes to change the word "Procedures" to "Guidelines". That immediately suggests that the Appendix is not intended to be "legally binding" on the IPCC and its Working Groups, but merely an "Aim" that could be ignored or waived by the IPCC chairman, the IPCC Bureau, or others and they could do so without IPCC approval. That possibility or interpretation does not bode well for assuring that reports are "comprehensive, objective, open and transparent".

I understand that the term "Procedures" has been in use since the IPCC's ninth session in June 1993, and that the Second Assessment Report was successfully prepared and issued in accordance with them. The term "Procedures" was not a hindrance. I see no reason to change it to "Guidelines" and do not understand why it is even being proposed for adoption. Such a change will immediately suggest a weakening of the standards for developing IPCC reports that are a mixed-bag of scientific, socio-economic, and technical assessments. Even the term "Procedures" is weak. "Rules" would be better. However, "Guidelines" is a far distance from even a hint of a rule. I urge that the U.S. delegation, at the IPCC, insist that term "Procedures" be retained when, and if, this document is considered by the IPCC. If you disagree, please explain why.

This new document also states that it "Incorporates all Government comments received" by the Ad-Hoc Group as of August 21, 1998 and that:

> "Although compromise text has been inserted where several Governments have suggested similar changes to a particular phrase, all suggested changes have been shown. No judgment has been made as to whether a suggested change should be accepted or not.
>
> *****
>
> "Proposed deletions to the existing principles and Procedures are shown by strike-outs and proposed insertions by double-underlines."

The above statements are simply not true. The enclosed note to this letter, which was prepared by my staff, demonstrates that there are a number of changes made to the "existing" 1993 Procedures that are not shown by strike-outs or double-underlines. Many are significant and substantive. By not showing such changes, one must presume that judgments were, in fact, made. I believe such a misleading process is unfair and that the U.S. delegation should oppose consideration of such a document when the IPCC convenes under its proposed agenda to address these Procedures. Again, if you disagree, please explain why.

Additionally, it is my understanding that the IPCC and its past and present Chairmen have been saying that they wanted more involvement and input from the private sector which, I believe, is good. However, my staff's review of the changes to the existing Procedures and the proposals for the writing team for the Synthesis Report, fails to show how this new idea will be carried out. Some of the changes involving review by experts would seem to limit, not expand, private sector involvement and input. Please explain how the IPCC plans to achieve this objective and why the above documents apparently fail to carry it out.

The second document (IPCC-XIV/Doc 8 (25-VIII-1998)) is about the proposed "TAR Synthesis Report". It is a submission by the IPCC Chairman, Dr. Robert T. Watson.

Before commenting on this document, I note that item 11 of the enclosure to this letter shows that all of the paragraphs applicable to a Synthesis Report in the "existing" IPCC Procedures approved in 1993 are deleted from the new Appendix A, including the following:

> "The IPCC synthesis report is intended to provide an overview and synthesis of the Executive Summaries and the Summaries for Policymakers of the Working Groups. It should receive full review by participating governments and organizations.
>
> "Initial drafting of the IPCC synthesis report will be undertaken by the IPCC Chair and Working Group Co-Chairs. The draft should be made available for government and participating organization review for not less than six weeks. The revised draft should be made available to participating governments and organizations not less than one month before the Panel Plenary meeting called for the purposes of line-by-line approval of the draft."

As I have commented before, the proposed amendments to the existing IPCC Procedures are a significant, and I believe, an inappropriate and improper, departure from the "existing" Procedures. As stated by Dr. Watson, the new proposal calls for a 55 page report that would not be an "overview and synthesis of the Executive Summaries and the Summaries for Policymakers of the Working Groups". Instead, Dr. Watson states that 45 pages are "to highlight the key policy-relevant findings in the form of providing scientific and technical information to a short series of policy-relevant scientific questions that are mostly not WG-specific." He then lists thirteen questions which, upon review, are clearly not all "scientific" questions (e.g. questions 7, 8 and 10).

Despite this serious concern, Dr. Watson wants to abandon totally line-by-line approval by governments and participating organizations of these 55 pages, including the 45 pages focusing on such questions. He suggests, for the first time, three new alternative approaches to line-by-line approval, , saying that he "polled" the IPCC Bureau Members and found that "the majority believes" that the IPCC Governments should adopt approaches 1 or 3. However, none of the "approaches" he suggests conform to the "existing" Procedures or to the proposed amendments to those Procedures that are applicable to a Synthesis Report. None have apparently been considered even by the Ad-Hoc Group.

The timing of the Synthesis Report is such that issues such as these do not need to be resolved at the next session of the IPCC. The questions and the process need further vetting in an open and transparent manner. That has not occurred in the IPCC. It certainly has not occurred in the United States. Indeed, you have yet to answer my questions about these matters, which included requests for a copy of the "proposed questions" circulated earlier this year by the IPCC Chairman or Secretariat and the U.S. delegation's comments thereon, as well as any questions proposed by the U.S. I think it is fair to say few in Congress or the public are even aware of these matters or their significance. Your Department and the Administration have not sought public or Congressional input.

I again urge that the U.S. delegation insist on retaining the existing Producers on line-by-line approval for the Synthesis Report and that the questions not be approved in their present form until there is more opportunity to examine them.

Finally, I understand that there have been Japanese media article reports about a U.S. proposal for "sharing quotas" and, in exchange, the Unites States and Japan would provide Pacific Rim countries with "environmental, technical, and financial assistance." Please provide the details of the U.S. proposal, including its costs for the U.S. and the authority for offering and implementing such a proposal. Is this proposal consistent with your commitments that the Administration not implement the Kyoto Protocol prior to Senate advice and consent to ratification?

I request your response by October 9, 1998 to the above matters, together with a detailed summary of the actions taken by the IPCC and its Working Groups and its Bureau beginning September 28th. Of course, I expect the responses to my earlier letters, which are long overdue, before the IPCC session begins.

Sincerely,

F. JAMES SENSENBRENNER, JR.
Chairman

FJS/hlw

Enclosure

Enclosure to September 18, 1998 Letter from Science Committee Chairman F. James Sensenbrenner, Jr. to the Honorable Stuart E. Eizenstat

EXAMPLES OF CHANGES, DELETIONS AND INSERTIONS MADE TO IPCC PROCEDURES THAT ARE NOT IDENTIFIED BY STRIKE-OUTS AND DOUBLE UNDERLINES IN IPCC DOCUMENT (IPCC-XIV/DOC 5) CIRCULATED TO IPCC MEMBERS

1. Page 1, para. number 6: lines 42-45. Sentences on lines 42 and 44 are new insertions to old Appendix A "Principles Governing IPCC Work", which is proposed to be inserted at beginning of document.

2. Page 5, lines 28 and 29: a new sentence has been inserted that is not in the current Procedures.

3. Page 6, lines 15 and 28 and Page 7, line 42: The words "countries and participating organizations" have been deleted and the words "governments, organizations with relevant expertise" have been substituted without strike-outs and double-underlinings.

4. Page 6, lines 33-36: the sentence beginning on line 33 is new and there is no double-underlining.

5. Page 7, lines 6-8: the sentence beginning on line 6 is new and there is no double-underlining.

6. Page 7, lines 42-44: the sentence that begins on line 42 is new and there is no double underlining.

7. Page 8, line 23: the following sentence was deleted and there is are no strike-outs:

   > "If time allows, a revised draft incorporating comments, together with any appropriate summary, should be circulated again for review by experts"

8. Page 8, lines 29-30: the words "who provided comments during the first review" are stricken with a line. However, they do not appear in the current Procedures.

9. Page 8, lines 39-40: this sentence is new and it is not double-underlined.

10. Page 9, lines 35-36: the word "signifies" has been deleted from current Procedures and the words" "is aimed at ensuring" have been substituted. There are no strike-outs or double-underlinings.

11. Page 10, lines 10-23: these paragraphs are all new. The current paragraphs are not shown and there are no strike-outs and double-underlinings.

COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Hearing
on

The Road from Kyoto—Part 3: State Department Overview

Thursday, March 5, 1998

Post-Hearing Questions
Submitted to

The Honorable Stuary E. Eizenstat
Under Secretary of State for Economic, Business and Agricultural Affairs
U.S. Department of State

Additional Post-Hearing Questions Submitted by Chairman Sensenbrenner on September 18, 1998

Intergovernmental Panel on Climate Change (IPCC)

Proposed Change of IPCC "Procedures" to IPCC "Guidelines"

Q1. The Congressman noted that "...the proposed change of the word 'Procedures' to 'Guidelines' suggests that the document (Appendix A of IPCC-XIV/Doc. 5) is not intended to be 'legally binding' on the IPCC and its Working Groups, but merely an 'Aim' that could be ignored or waived by the IPCC Chairman, the IPCC Bureau, or others and they could do so without IPCC approval ... (s)uch a change will immediately suggest a weakening of the standards for developing IPCC reports..." He urged "the U.S. delegation, at the IPCC, (to) insist that the term 'Procedures' be retained when, and if, this document is considered by the IPCC."

A1. At the XIV^th^ Plenary of the IPCC in Vienna, the U.S. delegation noted its objection to the proposed change of the title of the IPCC "Procedures" to "Guidelines". The representatives of the Russian Federation and Saudi Arabia raised a counter objection in support of the change. Ultimately, the IPCC Panel accepted the U.S. position to reject the proposal, thus retaining the title of Appendix A as "Procedures for the Preparation, Review, Acceptance, Approval and Publication of IPCC Reports."

Changes Made to the Existing 1993 IPCC Procedures

Q2. The Congressman noted that the statement, "(p)roposed deletions to the existing Principles and Procedures are shown by strike-outs and proposed insertions by double underlines" is incorrect, and "that there are a number of changes made to the 'existing' 1993 Procedures that are not shown by strike-outs or double-underlines." He urged that "the U.S. delegation should oppose consideration of such a document when the IPCC convenes under its proposed agenda to address these Procedures."

A2. The U.S. delegation noted the difficulty in adequately evaluating proposed changes in the principles and procedures documents due to the fact that the text did not reflect changes from the existing principles and procedures as approved at the IXth IPCC Plenary in Geneva, 29-30 June 1993. Mr. Warrilow, Chair of the Ad Hoc Group on Procedures, apologized for this unfortunate clerical error but noted that it was not possible to produce a revised document while the Panel was meeting in Vienna. The Panel therefore agreed to table the discussion for future consideration. IPCC Chairman, Dr. Watson, announced that a revised draft of the Procedures will be submitted to governments for their review and comment. He assured the Panel that the revised draft will clearly indicate all proposed changes to be made in the existing Procedures, and that all comments will be collated and available to all governments before the next IPCC Plenary session. This issue will be taken up at the next IPCC Plenary to be held in April 1999. The venue has yet to be decided.

Involvement In and Input to the IPCC from the Private Sector

Q3. The Congressman noted "that the IPCC and its past and present Chairmen have been saying that they wanted more involvement and input from the private sector... (yet) the existing Procedures and the proposals for the writing team for the Synthesis Report ... (fail to indicate) how the IPCC plans to achieve this objective." He asks for an explanation.

A3. The Congressman is correct in his observation that, historically, the private sector's participation in IPCC process has been minimal. Currently, the private sector is involved with the IPCC on several different levels. Representatives of the private sector, including those with academic posts and research positions in not-for-profit institutions have been nominated to contribute to the IPCC working groups or special reports, as either authors or reviewers. An example of this type of communication and exchange was evident in the recent efforts by the U.S. Technical Support Unit (TSU) of the IPCC Working Group II to canvass the aviation industry. A staff member at Dupont served as the coordinator in contacting industry professionals and inviting them to review and comment on the draft copy of the IPCC Special Report on Aviation and the Global Atmosphere. Several corporate representatives have submitted their comments directly to the IPCC Secretariat who, in turn, will forward these on to the lead authors to aid in their revisions.

Appendix B of IPCC document [IPCC-XIV)/Doc. 3 (27-VIII-1998)] entitled "The IPCC Third Assessment Report Decision Paper" presents the IPCC's commitment to promote the participation of experts from industry, academia, and environmental organizations. This section is repeated below:

> 10. Promoting the Participation of Experts from Business/Industry/Finance, Development and Environmental Organizations
>
> (i) The IPCC agrees that non-government experts, including those from business, industry, finance and development and environmental organizations, with relevant expertise, should be involved in the preparation and review of the Third Assessment Report;
>
> (ii) The IPCC agrees that its Bureau and the TSUs assist the IPCC Secretary in identifying those experts;
>
> (iii) The IPCC agrees that it will be critical to have balance, including geographic balance, within and between experts from various non-governmental organizations. These experts will act in their personnel capacity, bring to bear their scientific, technological and economic expertise

Policy-oriented environmental and industry-sponsored representatives meet with State Department staff in the Office of Global Change on an informal basis and have the opportunity to express their comments and concerns which are conveyed to the IPCC Secretariat or others as appropriate. Private sector representatives may also attend all IPCC meetings with the exception of the Bureau meetings, and are free to participate in IPCC Plenary and Working Group meetings.

The IPCC is a scientific body and a hallmark of that scientific character or "culture" is fostering open communication and allowing interested parties to contribute. The need to include the private sector constituency has been brought to the attention of the IPCC. Members of the IPCC are sensitive to the need and will make a concerted effort to encourage such participation as evident in the decision paper as referenced above.

Approval Process of the IPCC Third Assessment Report (TAR) Synthesis Report and Policy-Relevant Scientific Questions

Q4. The Congressman noted that the IPCC Chairman, Dr. Watson, presents "...three alternative approaches to line-by-line approval of the Synthesis Report ... (yet) none of these approaches conform to the 'existing' Procedures or to the proposed amendments to the Procedures that are applicable to a Synthesis Report. The Congressman recommended "that the U.S. delegation insist on retaining the existing (Procedures) on line-by-line approval for the Synthesis Report and that the questions (identified as scientific policy-relevant questions that serve as a framework to guide the synthesis) not be approved in their present form until there is more opportunity to examine them."

A4. Approval process of the TAR Synthesis Report.

The TAR will consist of the three IPCC Working Group Reports (each with a Summary for Policymakers, a Technical Summary, and the supporting chapters, each with an Executive Summary) and a Synthesis Report. The Synthesis Report is a new element of an IPCC Assessment Report. At IPCC XIII in the Maldives (September 1997) the Panel agreed that a Synthesis Report should be prepared based on the Third Assessment Report that would deal with key policy-relevant scientific questions. It was agreed that the Synthesis Report would consist of two elements: a short (5-10 page) Summary for Policymakers which would be approved line-by-line in an IPCC plenary session, and the so-called "longer report" (30-50 pages). In Vienna, views differed over whether the longer report would be subject to a different approval procedure because of the difficulty and time required to approve a document of its anticipated length in plenary sessions.

Prior to the XIVth Plenary, IPCC Chairman Dr. Watson proposed five options for dealing with the longer report. At the beginning of the XIVth Plenary and based on discussions with key countries, he proposed yet another approach. As finally agreed in Vienna, the IPCC Plenary will provisionally approve the Summary for Policymakers line-by-line in plenary. The Plenary will also review the longer report for consistency with the Summary for Policymakers and the three underlying Working Group reports. If changes are required to achieve consistency, the lead authors will write the necessary changes with the help of Bureau members who are not authors serving as reviewers. Once changes are made to ensure consistency, the revised longer report will then be brought back to the Plenary for review and adoption. The longer report will be adopted section-by-section rather than line-by-line. At the end of this process, the entire Synthesis Report (the Summary for Policymakers and the longer report) will be adopted by the Panel.

In an effort to reach consensus, the U.S. delegation put forward a new proposal which would allow "provisional approval" of the Summary for Policymakers and final plenary adoption of the entire Synthesis Report. In practice, however, it is possible, that the agreed approach will amount to line-by-line approval of the longer report (and a protracted plenary session in order to reach consensus).

The policy-relevant scientific questions:

The list of policy-relevant scientific questions, was formulated by Dr. Watson, based on initial input from various governments through the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the U.N. Framework Convention on Climate Change (UN-FCCC). The questions were distributed to governments prior to the meeting in Vienna. They were not discussed in open session during the XIVth Plenary however, although several delegations, including the U.S. delegation, expressed concern that the list of questions, as proposed, required substantial restructuring and further clarification. U.S. scientists believe that if the Synthesis Report is carefully structured to answer policy-relevant scientific questions in a succinct, yet policy-neutral manner, it should prove to be a powerful tool for policymakers. The Report's effectiveness however will depend on its authors' ability to answer such questions in adequate detail and length in the longer report. Thus, the decision on how the final Synthesis Report will be approved (both the summary for policymakers and the longer report) greatly influences the length of the longer report.

The XIVth Plenary closed before the IPCC could complete its review or agree on the key policy-relevant scientific and technical questions that will form the basis for the Synthesis Report. At the conclusion of the meeting it was agreed that governments would have the opportunity to submit their comments on the initial set of questions to Dr. Watson. They may also suggest alternate policy-relevant questions for consideration.

Dr. Watson will then draft a new set of questions and distribute these to governments for review. The Chair noted that all comments would be collated and provided to governments before this next session to facilitate reaching agreement on a final list of questions. At the next IPCC Plenary meeting in April 1999, the full Plenary will consider the revised list of questions .

Japanese Media Article Reports About a U.S. Proposal for "Sharing Quotas" and, in Exchange, United States and Japan Provision to Pacific Rim Countries of "Environmental, Technical, and Financial Assistance"

Q5. The Congressman comments "that there have been Japanese media article reports about a U.S. proposal for 'sharing quotas' and, in exchange, the United States and Japan would provide Pacific Rim countries with 'environmental, technical, and financial assistance.' " He then asks to "(p)lease provide the details of the U.S. proposal, including its costs for the U.S, and the authority for offering and implementing such a proposal. Is this proposal consistent with your commitments that the Administration not implement the Kyoto Protocol prior to Senate advice and consent to ratification?"

A5. We are not aware of any proposal, as described, for sharing quotas in exchange for environmental, technical, and financial assistance.

APPENDIX 3: Additional Materials for the Record

Kyoto Protocol and the United Nations Framework Convention on Climate Change

UNITED
NATIONS

Framework Convention
on Climate Change

Distr.
GENERAL

FCCC/CP/1997/7
18 March 1998

Original: ENGLISH

CONFERENCE OF THE PARTIES

REPORT OF THE CONFERENCE OF THE PARTIES ON ITS THIRD SESSION, HELD AT KYOTO FROM 1 TO 11 DECEMBER 1997

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Annex Table: Total carbon dioxide emissions of Annex I Parties, for the purposes of Article 25 of the Kyoto Protocol

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[*] Part Two of this report is contained in document FCCC/CP/1997/7/Add.1.

I. OPENING OF THE SESSION

(Agenda item 1)

1. The third session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, convened pursuant to Article 7.4 of the Convention and decision 1/CP.2, was opened at the Kyoto International Conference Hall, Kyoto, Japan, on 1 December 1997, by the President of the Conference at its second session, Mr. Chen Chimutengwende, Minister of Information, Posts and Telecommunications of Zimbabwe.

A. Statement by the President of the Conference at its second session

(Agenda item 1 (a))

2. The President of the Conference at its second session welcomed all participants to the third session of the Conference of the Parties and thanked the Government of Japan for the excellent facilities it had provided. He said that, since the second session of the Conference, climate change had been the subject of growing worldwide attention and media coverage. The Convention process itself had also made considerable progress, mainly through the work of the subsidiary bodies. The Ad Hoc Group on the Berlin Mandate (AGBM), in particular, had arrived step by step at a consolidated negotiating text for a protocol or another legal instrument, prepared by the Chairman. The adoption of such a protocol or instrument reflecting the principles of equity, justice and fair play constituted the greatest challenge of the current session.

3. Global warming was already happening and the climate system might well be taking an irreversible path unless action was taken immediately. While climate change constituted a threat to each and every individual nation in the world, its impact was likely to be more severe in the developing countries that were least able to cope with the consequences. It was the responsibility of the industrialized nations that had indirectly placed burdens on the rest of the world to take the lead in meeting existing commitments, in reducing emissions and in alleviating human suffering caused by climate change. It was a question of survival for small island States and other low-lying areas of the world and for vulnerable communities in other poor countries. Developing countries were already making efforts domestically, with their limited resources, to attain sustainable economic development and it was not possible for those countries to take on new commitments under the new instrument. In the interests of equity, binding commitments for non-Annex I Parties could not even be envisaged until agreement had been reached on a fair system of apportionment of emission limits, a globally agreed reduction pathway and a projected sustainable future emission level on an equitable basis, and until there was reliable and predictable financial provision for the acquisition and adaptation of sound technologies, know-how and production systems in developing countries.

4. In conclusion, he reported to the Conference of the Parties on the outcome of the informal consultations which he had undertaken in the intersessional period on the draft rules of procedure and the composition of the Bureau. Thanking all those who had co-operated with him during his term of office, and extending his best wishes to the new President, he expressed the hope that the session would prove to be a success and a landmark in the annals of international cooperation.

B. Election of the President of the Conference at its third session
(Agenda item 1 (b))

5. At the 1st plenary meeting, on 1 December, on the proposal of the outgoing President, the Conference of the Parties elected by acclamation Mr. Hiroshi Ohki, Minister of State, Director-General of the Environment Agency, Minister in Charge of Global Environmental Problems of Japan, as its President.

C. Statement by the President
(Agenda item 1 (c))

6. On assuming office, the President welcomed all participants to the third session of the Conference of the Parties and paid tribute to the outgoing President and the Chairman of the AGBM for their important contributions to the Convention process. He also thanked the Executive Secretary and the secretariat for their work in preparing for the present session of the Conference. The most important task facing the Conference of the Parties was to establish a more concrete international framework for the protection of the global climate through the adoption of a protocol to the Convention or another form of legal instrument. Climate change was one of the most serious global environmental issues facing the world today and only a fully worldwide strategy could effectively address the problem. Such a strategy should be based on three principles: developed countries should take the lead now in committing themselves to reduce greenhouse gas emissions below 1990 levels; developing countries should also take actions to address the issue of climate change in promoting their sustainable development, taking into account their common but differentiated responsibilities under the Convention and their respective capabilities; and developed countries should strengthen their partnership with developing countries through the provision of financial and technological support for mitigating global greenhouse gas emissions.

7. There were a large number of outstanding issues to be resolved and he called upon all Parties to work together in a spirit of cooperation and compromise, urging the developed countries with the greatest economic capacity in particular to demonstrate such spirit and leadership in action. In conclusion, he stressed the need to discuss future steps to be taken after the Kyoto Conference for the effective implementation of the protocol and other measures to attain the objective of the Convention. All the climate change problems could not be solved at Kyoto; there was still a long way to go and many more negotiations would have to follow. By reaching agreement at Kyoto, however, the international community could take a definite first step towards promoting climate protection policies for the twenty-first century. It was his earnest hope that, here in Kyoto, where some of the most important events in Japan's history had taken place, it would prove possible to reach another historic decision to protect the world's environment and to secure a sustainable basis for the future prosperity of all mankind.

D. Addresses of welcome
(Agenda item 1 (d))

8. Mr. Keizo Obuchi, Minister for Foreign Affairs of Japan, speaking on behalf of the Government of Japan, welcomed all participants to Kyoto, the ancient capital of Japan, for the third session of the Conference of the Parties. He said that the problem of global warming was rapidly becoming more acute, with severe consequences not only for future generations but also for the world's ecosystems. It was the present generation's historic responsibility to determine the future shape of the earth that it would hand over to future generations. The Kyoto Conference was a crucial opportunity to take a global decision on the extent to which greenhouse gas emissions could be limited in order to combat global warming after the year 2000. Agreement needed to be reached on legally-binding emission reduction targets for developed country Parties. At the same time, developing countries should be asked to make every effort, in their future development activities, to take into account the future of the whole world. To that end, appropriate assistance from developed countries was indispensable. In conclusion, he expressed his earnest hope that the Conference would be able to reach the final agreement the world was waiting for.

9. Mr. Teiichi Aramaki, Governor of the Prefecture of Kyoto, welcomed all participants to the third session of the Conference of the Parties, on behalf of all the residents of the Kyoto Prefecture. He said that global warming was one of the most serious environmental problems facing the world today, and that the third session of the Conference of the Parties might well be an important step in tackling global warming in the coming century through the united efforts of all the peoples of the world. For its part, the Kyoto Prefecture had prepared various action programmes to protect the environment, based on the active involvement of local people, business circles, administrative bodies and tourists, and the present Conference provided an opportunity to enhance the local population's awareness of global environmental issues and thus further promote such activities. In conclusion, he wished the Conference every success in arriving at a Kyoto Protocol that would prove to be a landmark in international cooperation for preserving the global environment.

10. Mr. Morikane Masumoto, Mayor of Kyoto, speaking on behalf of all the citizens of Kyoto, welcomed the participants in the Conference to the host city of Kyoto. With a history and tradition of more than 1,200 years, Kyoto was called "a place dear to the heart of every Japanese". The Mayor expressed his delight in the thought that all the participants would have an opportunity to experience the beautiful nature and culture of Kyoto, a world-famous ancient city. Recognizing that the earth was now suffering from damage that humankind alone had caused, the Mayor stressed that it was humankind's responsibility to save the suffering earth, restore the global environment and hand it over to future generations. Since July 1996, when the decision to hold the Conference in Kyoto was taken, the City of Kyoto had organized more than 120 events and projects to raise the citizens' awareness of the urgency of combatting global warming and of the significance of the present Conference. The City of Kyoto had also drawn up a Kyoto City Regional Promotion Plan to help stop global warming, with the aim of reducing CO_2 emissions. To implement that programme, the Miyako Agenda 21 action plan had been drafted. In

conclusion, the Mayor expressed his earnest hope that the Conference would reach a successful agreement with the adoption of an effective Kyoto Protocol.

E. Statement by the Executive Secretary

(Agenda item 1 (e))

11. At the 1st plenary meeting, on 1 December, the Executive Secretary, welcoming all participants to the third session of the Conference of the Parties and thanking the Government of Japan and the Kyoto authorities for all they had done to help the secretariat to put the arrangements for the Conference in place, stressed the importance of the Conference arriving at a well-designed end product that could be successfully sold not only to legislators and tax payers, but also to investors, producers and consumers. The responsibility for investments and other actions that would lead to the limitation and reduction of greenhouse gas emissions would fall primarily on non-governmental actors, in particular the business community. For the business community to be able to respond in a responsible manner, it was essential that the goals, and the rules of the game for achieving them, were clearly defined by Governments. The Conference must also direct its message to the citizens of the world in order to mobilize support for practical actions by communities and local governments to mitigate greenhouse gas emissions. Finally, the message from Kyoto should clearly indicate that it was only through the example of enlightened leadership by the industrialized countries, and by the transnational corporations that were shaping the world economy, that a truly global coalition to combat climate change could be formed, in which all would participate according to their own capacities. He looked forward to a clear, binding and verifiable commitment by the industrialized countries to reduce their emissions below 1990 levels early in the next century, a commitment that would trigger the development and diffusion of new practices, new standards, new technologies and new consumption patterns. Such a result would start to steer the world economy towards a sustainable future.

F. Other statements

12. At the 1st plenary meeting, on 1 December, general statements were made by the representatives of the United Republic of Tanzania (on behalf of the Group of 77 and China), Luxembourg (on behalf of the European Community and its member States), the Russian Federation and the United States of America. At the 2nd plenary meeting, on 1 December, general statements were made by the representatives of Egypt (on behalf of the African Group) and Samoa (on behalf of the Alliance of Small Island States). At the 3rd plenary meeting, on 3 December, a general statement was made by the representative of Slovenia (on behalf of the Group of Central and Eastern European States).

II. ORGANIZATIONAL MATTERS

(Agenda item 2)

A. Status of ratification of the Convention

(Agenda item 2 (a))

13. For its consideration of this sub-item at its 1st plenary meeting, on 1 December, the Conference of the Parties had before it an information document on the status of ratification of the Convention (FCCC/CP/1997/INF.2). On the invitation of the President, the Conference of the Parties took note with satisfaction that, as of 1 December 1997, 167 States and one regional economic integration organization were Parties to the Convention, and took note of the information on the status of ratification contained in document FCCC/CP/1997/INF.2.

14. At the 4th plenary meeting, on 3 December, the representative of Croatia formally objected to the participation of the representative of the Federal Republic of Yugoslavia in the third session of the Conference of the Parties, and to the inclusion of the name of Yugoslavia in the list of Parties in document FCCC/CP/1997/INF.2. He said that the Federal Republic of Yugoslavia was not a member State of the United Nations and thus, in accordance with Article 20 of the Convention, was not entitled to become a Party to the Convention. He therefore requested the presidency to ensure that the representative of the Federal Republic of Yugoslavia did not participate in the meetings of the Conference of the Parties.

15. The Executive Secretary explained that the list of Parties in document FCCC/CP/1997/INF.2 was based on information received from the Secretary-General of the United Nations as Depositary of the Convention. On 10 September 1997 the secretariat had received a communication from the Chief of the Treaty Section advising it of the deposit of an instrument of ratification by Yugoslavia on 3 September 1997. On 24 November 1997 the secretariat had received a copy of a depositary notification from the Legal Office of the United Nations, which conveyed the same information to the Ministries of Foreign Affairs of all Parties and which stated that, in accordance with Article 23.2, Yugoslavia would become a Party to the Convention on 2 December 1997. He informed the Conference of the Parties that he would seek the advice of the Depositary of the Convention on the issue raised.

16. The representatives of Mauritania, Morocco (speaking as Chairman of the Islamic Conference), Luxembourg (speaking on behalf of the European Community and its member States), Pakistan and the United States of America, all supported the request made by the representative of Croatia. The representatives of Georgia and of the Russian Federation, on the other hand, expressed their support for participation by the Federal Republic of Yugoslavia.

17. At the same meeting, the presiding Vice-President requested the representative of the Federal Republic of Yugoslavia to refrain from participating in the proceedings of the Conference pending receipt of legal advice from the Depositary.

18. At the 5th plenary meeting, on 5 December, the Executive Secretary informed the Conference of the Parties that a legal opinion had been received from the Legal Counsel of the

United Nations. In that opinion, the Legal Counsel had explained that, at the time of the signature of the Convention by the Federal Republic of Yugoslavia on 8 June 1992, no decision on its status having been taken by the General Assembly, the Secretariat had not questioned the membership of Yugoslavia in the United Nations and its participation in treaties negotiated under United Nations auspices. It was on that basis that the Secretariat had accepted the signature. The Legal Counsel also had taken the view in 1992 that General Assembly resolution 47/1 had not terminated or suspended Yugoslavia's membership in the United Nations. As regards the acceptance on 3 September 1997 of the deposit by the Federal Republic of Yugoslavia of an instrument of ratification of the Convention, that was not based on a treaty action taken by the former Socialist Federal Republic of Yugoslavia, but rather on the signature of the Convention by a representative of the Federal Republic of Yugoslavia. As General Assembly resolution 47/1, as consistently interpreted by the Secretariat, had not terminated or suspended Yugoslavia's membership in the United Nations, the Depositary had not been in a position not to accept the deposit of an instrument of ratification pursuant to Article 22 of the Convention. The capacity of the Federal Republic of Yugoslavia to participate in meetings of treaty bodies needed to be determined by the relevant treaty bodies themselves. It was thus for the Conference of the Parties itself to take a decision on the participation of the Federal Republic of Yugoslavia in UNFCCC meetings, if it so wished. Some other treaty bodies had taken action to exclude the representatives of the Federal Republic of Yugoslavia from participating in a particular meeting or session, but had avoided dealing with the larger legal issue of its treaty status.

19. The President, pointing out that the opinion of the Legal Counsel was consistent with the request made by the Vice-President presiding over the 4th plenary meeting, ruled that the request to the delegation of the Federal Republic of Yugoslavia to refrain from participating in the proceedings of the Conference should be maintained.

B. Adoption of the rules of procedure
(Agenda item 2 (b))

20. For its consideration of this sub-item at its 1st plenary meeting, on 1 December, the Conference of the Parties had before it the draft rules of procedure, as currently being applied (FCCC/CP/1996/2) and a report by the President of the Conference at its second session on his informal consultations on the draft rules of procedure (FCCC/CP/1997/5). Annex I to that report contained the text of a draft decision on adoption of the rules of procedure, proposed by the President of the Conference at its second session, whereby the Conference would adopt the rules of procedure annexed to that decision, with the exception of draft rule 22, paragraph 1, and draft rule 42, paragraph 1, on the understanding that draft rule 22, paragraph 1, would continue to be applied.

21. Statements were made by representatives of seven Parties, including one speaking on behalf of the Group of 77 and China, one speaking on behalf of the Alliance of Small Island States and one speaking on behalf of the European Community and its member States. In the absence of a consensus on that draft decision, the President proposed, and the Conference of the Parties agreed, that consideration of the sub-item should be postponed to give time for further

consultations. The President ruled that the draft rules of procedure as contained in document FCCC/CP/1996/2 should continue to be applied, with the exception of draft rule 42.

22. At the 12th plenary meeting, on 11 December, the Conference of the Parties, on the proposal of the President, decided that adoption of the rules of procedure should be placed on the agenda for the fourth session of the Conference. The President indicated that, if he sensed a move towards a compromise on that issue, he would undertake further consultations and report back to the Conference of the Parties at its fourth session.

C. Adoption of the agenda
(Agenda item 2 (c))

23. For its consideration of this sub-item at its 1st plenary meeting, on 1 December, the Conference of the Parties had before it a note by the Executive Secretary containing the provisional agenda and annotations (FCCC/CP/1997/1 and Add.1-2) and a proposal by the Group of 77 and China in relation to item 6 of the provisional agenda (FCCC/CP/1997/L.1), listing issues for the focus of the high-level segment attended by ministers and other heads of delegation.

24. At the same meeting, on 1 December, the Conference of the Parties adopted the following agenda:

1. Opening of the session:
   - (a) Statement by the President of the Conference at its second session;
   - (b) Election of the President of the Conference at its third session;
   - (c) Statement by the President;
   - (d) Addresses of welcome;
   - (e) Statement by the Executive Secretary.
2. Organizational matters:
   - (a) Status of ratification of the Convention;
   - (b) Adoption of the rules of procedure;
   - (c) Adoption of the agenda;
   - (d) Election of officers other than the President;
   - (e) Admission of organizations as observers;

(f) Organization of work, including the establishment of a sessional Committee of the Whole;

(g) Calendar of meetings of Convention bodies 1998-1999;

(h) Date and venue of the fourth session of the Conference of the Parties;

(i) Adoption of the report on credentials.

3. Review of the implementation of the Convention:

(a) Reports of the subsidiary bodies and matters arising therefrom:

(i) Reports of the Subsidiary Body for Scientific and Technological Advice;

(ii) Reports of the Subsidiary Body for Implementation;

(iii) Reports of the Ad Hoc Group on the Berlin Mandate;

(iv) Reports of the Ad Hoc Group on Article 13;

(b) Development and transfer of technologies;

(c) Financial mechanism: report of the Global Environment Facility to the Conference;

(d) Second review of the adequacy of Article 4.2(a) and (b);

(e) Review of information and possible decisions under Article 4.2(f);

(f) Other matters relating to implementation.

4. Amendments to the Convention and its Annexes:

(a) Proposal to amend Article 4.3;

(b) Proposal to amend Article 17;

(c) Proposals to amend Annexes I and II.

5. Adoption of a protocol or another legal instrument: fulfilment of the Berlin Mandate.

6. High-level segment attended by ministers and other heads of delegation.

7. Other matters.

8. Conclusion of the session:

   (a) Adoption of the report of the Conference of the Parties on its third session;

   (b) Closure of the session.

D. Election of officers other than the President
(Agenda item 2 (d))

25. At its 1st plenary meeting, on 1 December, on the proposal of the President, the Conference of the Parties elected by acclamation seven Vice-Presidents and the Rapporteur of the Conference, the Chairman of the Subsidiary Body for Scientific and Technological Advice and the Chairman of the Subsidiary Body for Implementation. The Bureau of the Conference was thus constituted as follows:

President

Mr. Hiroshi Ohki (Japan)

Vice-Presidents

Mr. Anthony Clarke (Canada)
Mr. Tengiz Gzirishvili (Georgia)
Ms. Cornelia Quennet-Thielen (Germany)
Mr. George Manful (Ghana)
Mr. Sergio Zelaya Bonilla (Honduras)
Mr. Espen Rønneberg (Marshall Islands)
Mr. Luis Herrera Marcano (Venezuela)

Rapporteur

Mr. Maciej Sadowski (Poland)

Chairman of the Subsidiary Body for Scientific and Technological Advice

Mr. Kok Kee Chow (Malaysia)

Chairman of the Subsidiary Body for Implementation

Mr. Bakary Kante (Senegal)

26. The Conference of the Parties agreed, on the proposal of the President, that consultations should continue with regard to nominations for the posts of vice-chairpersons and rapporteurs of the subsidiary bodies, with a view to their election at the next sessions of those bodies.

27. At its 2nd meeting, on 1 December, the Conference of the Parties elected Mr. Raúl Estrada-Oyuela (Argentina) as Chairman of the sessional Committee of the Whole and invited him to participate in the meetings of the Bureau of the Conference.

E. Admission of organizations as observers
(Agenda item 2 (e))

28. For its consideration of this sub-item at its 1st plenary meeting, on 1 December, the Conference of the Parties had before it a note by the secretariat on the admission of organizations as observers (FCCC/CP/1997/4), to which was annexed a list of intergovernmental and non-governmental organizations which had expressed their wish to be admitted as observers at the third session of the Conference of the Parties. Pursuant to a recommendation by the Bureau of the Conference, which had reviewed the list of applicant organizations during the October 1997 sessions of the subsidiary bodies, the Conference of the Parties decided to admit as observers to its third session the non-governmental organizations which had an asterisk against their names, and to accord observer status to the intergovernmental and remaining non-governmental organizations in that list. (See annex II of this document.)

F. Organization of work, including the establishment of a sessional Committee of the Whole
(Agenda item 2 (f))

29. In introducing this sub-item, at the 2nd plenary meeting, on 1 December, the President recalled that under Article 7.2 of the Convention the Conference of the Parties, as the supreme body of the Convention, was mandated to keep under regular review the implementation of the Convention and to make, within its mandate, the decisions necessary to promote the effective implementation of the Convention. Furthermore, Article 7.2(a) provided for the Conference of the Parties to periodically examine the obligations of the Parties and the institutional arrangements under the Convention, in light of the objective of the Convention, the experience gained in its implementation, and the evolution of scientific and technological knowledge. In that context, the principal objective of the Conference of the Parties at its third session was to fulfil the Berlin Mandate, set by its decision 1/CP.1, on the basis of the work of the AGBM. In addition, the Conference of the Parties would also consider for the first time amendments to the Convention proposed by Parties.

30. At the same meeting, the Conference of the Parties, pursuant to a recommendation by the SBI at its fifth session (FCCC/SBI/1997/6, para. 44 (c) (ii)), established a sessional Committee of the Whole, open to all delegations, to undertake consideration of agenda item 5 on fulfilment of the Berlin Mandate, and requested the Chairman of the Committee of the Whole to report to the plenary on the results of the Committee's work on Friday, 5 December. All remaining items were allocated to the plenary of the Conference. The Conference of the Parties, on the proposal

of the President, further decided that, of the issues reported to be outstanding by the Chairman of the AGBM (see paragraph 55 below), those relating to the methodologies to be used to estimate emissions by sources and removals by sinks in the new instrument, and preparations for the first meeting of the Parties to the Protocol, should be considered by the Committee of the Whole in connection with agenda item 5, and the issue relating to elements of the Brazilian proposal contained in document FCCC/AGBM/1997/MISC.1/Add.3 should be taken up by the plenary of the Conference under agenda item 3 (f). After an extensive discussion, the President indicated that he would undertake consultations on the question of how to deal with the issue relating to the future development of the commitments of all Parties.

31. With regard to agenda item 6, the President recalled that the purpose of the high-level segment, as defined by the SBI at its sixth session, was to promote decision-making (FCCC/SBI/1997/16, para. 34 (g)). It would mark the conclusion of the work of the sessional Committee of the Whole, and the handover of the negotiating process to ministers and other heads of delegation and their senior advisers for the final days of work before the adoption of a new instrument. The high-level segment would be marked by a series of intensive informal consultations as well as a general debate in the plenary.

32. On the proposal of the President, the Conference of the Parties decided that, during the general debate, the time limit for statements should be set at five minutes for statements by representatives of Parties and at four minutes for all other statements. It also decided that the list of speakers should be officially closed at 18.00 hours on Wednesday, 3 December.

33. At the same meeting, the Executive Secretary, referring to the report on the status of contributions to the core budget for the biennium 1996-1997 (FCCC/CP/1997/INF.4), appealed to all Parties that had not yet paid their 1996 or 1997 contributions to the core budget to do so as soon as possible, and expressed his appreciation to those Parties that had paid their contributions promptly and, in particular, to those Parties that had pledged additional amounts to the Trust Fund for Participation. The President endorsed the statement made by the Executive Secretary and added his full support to his plea for Parties with contributions still in arrears to remit their payments as soon as possible. At the 4th and 5th plenary meetings, on 3 and 5 December, the Executive Secretary gave further information on the receipt of contributions to the core budget.

34. At its 5th plenary meeting, on 5 December, the Conference of the Parties, having heard an interim report by the Chairman of the Committee of the Whole (see paragraph 77 below), requested the Committee of the Whole to complete its work by the end of Monday, 8 December. At the same meeting, it was agreed that there would be no need to take up agenda item 7, "Other matters".

G. Calendar of meetings of Convention bodies 1998-1999
(Agenda item 2 (g))

35. At its 5th plenary meeting, on 5 December, the Conference of the Parties, on the proposal of the President, adopted the following calendar of meetings of Convention bodies in 1998-1999:

(a) First sessional period in 1998: from 2 to 12 June;

(b) Second sessional period in 1998: from 2 to 13 November;

(c) First sessional period in 1999: from 31 May to 11 June;

(d) Second sessional period in 1999: from 25 October to 5 November.

H. Date and venue of the fourth session of the Conference of the Parties
(Agenda item 2 (h))

36. At the 5th plenary meeting, on 5 December, the President recalled that, in the absence of any offer from a Party to host the fourth session of the Conference of the Parties, the SBI, at its 7th session, had recommended a draft decision for adoption by the Conference of the Parties at the present session, which provided for the fourth session to be held in Bonn in November 1998 (see FCCC/SBI/1997/21, annex I, 7). The representative of Argentina conveyed his Government's invitation to the Conference of the Parties to hold its fourth session in Buenos Aires.

37. At the same meeting, the Conference of the Parties, having considered a proposal by the President (FCCC/CP/1997/L.2), adopted by acclamation decision 5/CP.3 on the date and venue of the fourth session of the Conference of the Parties. For the text of this decision, see Part Two, section I, of this report.

38. The President, on behalf of the Conference of the Parties, extended his sincere thanks to the Government of Argentina for its generous offer to host the fourth session of the Conference of the Parties. Such an offer truly underlined the commitment of the Government of Argentina to the Convention and the Convention process. The Executive Secretary expressed his appreciation to the Government of Argentina for its generous offer and said that he and his colleagues in the secretariat were looking forward to working closely with the Argentine authorities in the preparations for the fourth session of the Conference of the Parties.

I. Adoption of the report on credentials
(Agenda item 2 (i))

39. At its 12th plenary meeting, on 11 December, the Conference of the Parties took note of the report of the Bureau on the credentials of the representatives of Parties to the third session of the Conference of the Parties (FCCC/CP/1997/6), as orally amended by the Executive Secretary.

J. Attendance

40. The third session of the Conference of the Parties was attended by representatives of the following 158 Parties to the United Nations Framework Convention on Climate Change:

Albania
Algeria
Antigua and Barbuda
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Barbados
Belgium
Belize
Benin
Bhutan
Bolivia
Botswana
Brazil
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Canada
Cape Verde
Central African Republic
Chile
China
Colombia
Comoros
Congo
Cook Islands
Costa Rica
Côte d'Ivoire
Croatia
Cuba
Czech Republic
Democratic Republic of the Congo
Denmark
Djibouti
Dominica
Ecuador
Egypt
El Salvador
Eritrea
Estonia
Ethiopia
European Community
Fiji
Finland
France
Gambia
Georgia
Germany
Ghana
Greece
Grenada
Guatemala
Guinea
Guinea-Bissau
Honduras
Hungary
Iceland
India
Indonesia
Iran (Islamic Republic of)
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakstan
Kenya
Kiribati
Kuwait
Lao People's Democratic Republic
Latvia
Lebanon
Lesotho
Liechtenstein
Lithuania
Luxembourg
Malawi
Malaysia
Maldives
Mali
Malta
Marshall Islands
Mauritania
Mauritius
Mexico
Micronesia (Federated States of)
Monaco
Mongolia
Morocco
Mozambique
Myanmar
Nauru
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Niue
Norway
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Republic of Korea

Romania
Russian Federation
Saint Kitts and Nevis
Saint Lucia
Samoa
Saudi Arabia
Senegal
Seychelles
Singapore
Slovakia
Slovenia
Solomon Islands
South Africa
Spain
Sri Lanka
Sudan
Swaziland
Sweden
Switzerland
Syrian Arab Republic
Thailand
Togo
Trinidad and Tobago
Tunisia
Turkmenistan
Tuvalu
Uganda
Ukraine
United Arab Emirates
United Kingdom of Great Britain and Northern Ireland
United Republic of Tanzania
United States of America
Uruguay
Uzbekistan
Vanuatu
Venezuela
Viet Nam
Yemen
Yugoslavia
Zambia
Zimbabwe

41. The session was also attended by observers from the following States not parties to the Convention: Belarus, Brunei Darussalam, Holy See, Libyan Arab Jamahiriya, Palau and Turkey.

42. The following United Nations offices and programmes were represented:

United Nations
Economic and Social Commission for Asia and the Pacific (ESCAP)
United Nations Conference on Trade and Development (UNCTAD)
United Nations Development Programme (UNDP)
United Nations Environment Programme (UNEP)
World Food Programme (WFP)
United Nations University, Institute of Advanced Studies
United Nations Institute for Training and Research (UNITAR)
United Nations Non-Governmental Liaison Service
Convention to Combat Desertification (CCD).

43. The following specialized agencies and other organizations of the United Nations system were represented:

United Nations Educational, Scientific and Cultural Organization (UNESCO)
Intergovernmental Oceanographic Commission (UNESCO/IOC)
International Civil Aviation Organization (ICAO)
World Health Organization (WHO)
World Bank
World Bank/International Finance Corporation (IFC)
Global Environment Facility of the World Bank/UNDP/UNEP (GEF)
World Meteorological Organization (WMO)
WMO/UNEP Intergovernmental Panel on Climate Change (IPCC)

International Maritime Organization (IMO)
United Nations Industrial Development Organization (UNIDO)
International Atomic Energy Organization (IAEA)
World Trade Organization (WTO)

44. For a list of the intergovernmental and non-governmental organizations attending the Conference, see annex II below.

K. Documentation

45. The documents before the Conference of the Parties at its third session are listed in annex III below.

III. REVIEW OF THE IMPLEMENTATION OF THE CONVENTION

(Agenda item 3)

A. Reports of the subsidiary bodies and matters arising therefrom

(Agenda item 3 (a))

1. Reports of the Subsidiary Body for Scientific and Technological Advice

(Agenda item 3 (a) (i))

46. At the 2nd plenary meeting, on 1 December, the Chairman of the Subsidiary Body for Scientific and Technological Advice (SBSTA) introduced the reports of the SBSTA on the work of its fourth, fifth, sixth and seventh sessions, contained in documents FCCC/SBSTA/1996/20 and FCCC/SBSTA/1997/4, 6, and 14, respectively, and reviewed the issues considered by the SBSTA during those sessions. He drew attention to a number of draft decisions which the SBSTA, at its seventh session, had recommended for adoption by the Conference of the Parties at its present session, the texts of which were contained in document FCCC/SBSTA/1997/14, annex I. Two of those draft decisions, relating to the development and transfer of technologies and to activities implemented jointly under the pilot phase, had been recommended for adoption by both the SBSTA and the SBI at their seventh sessions.

47. At the same meeting, the Conference of the Parties took note of the above-mentioned reports of the SBSTA, together with the oral report of the Chairman, and expressed its appreciation to the outgoing Chairman of the SBSTA, Mr. Tibor Faragó (Hungary), for his dedication and valuable leadership in steering the work of the SBSTA. At the same meeting, the Conference of the Parties adopted the following decisions that had been recommended for adoption by the SBSTA:

- Cooperation with the Intergovernmental Panel on Climate Change (decision 7/CP.3)
- Development of observational networks of the climate system (decision 8/CP.3)
- Development and transfer of technologies (decision 9/CP.3)
- Activities implemented jointly under the pilot phase (decision 10/CP.3)

For the texts of these decisions, see Part Two, section I, of this report.

48. In connection with the adoption of decision 7/CP.3 on cooperation with the Intergovernmental Panel on Climate Change, statements were made by the Chairman Emeritus of the IPCC, Professor Bert Bolin, and by the Executive Secretary, the latter expressing appreciation to Professor Bolin on behalf of the secretariat. The President extended his sincere thanks to Professor Bolin, on behalf of the Conference of the Parties, for his noteworthy contributions to the Convention process and for his role in advancing the global understanding of climate change as Chairman of IPCC for almost a decade.

2. Reports of the Subsidiary Body for Implementation
(Agenda item 3 (a) (ii))

49. At the 2nd plenary meeting, on 1 December, the Chairman of the Subsidiary Body for Implementation (SBI) introduced the reports of the SBI on the work of its fourth, fifth, sixth and seventh sessions, contained in documents FCCC/SBI/1996/14 and FCCC/SBI/1997/6, 16 and 21, respectively, and reviewed the issues considered by the SBI during those sessions. He drew attention to a number of draft decisions which the SBI, at its sixth and seventh sessions, had recommended for adoption by the Conference of the Parties at its present session, the texts of which were contained in document FCCC/SBI/1997/21, annex I. One of those draft decisions, relating to the division of labour between the Subsidiary Body for Implementation and the Subsidiary Body for Scientific and Technological Advice, had been jointly recommended by the SBI and the SBSTA. Another draft decision, relating to communications from Parties included in Annex I to the Convention, had been recommended by the SBI but contained an input from the SBSTA.

50. At the same meeting, the Conference of the Parties took note of the above-mentioned reports of the SBI, together with the oral report of the Chairman, and expressed its appreciation to the outgoing Chairman of the SBI, Mr. Mohamed M. Ould El Ghaouth (Mauritania), for his leadership and his valuable contributions to the work of the SBI. At the same meeting, the Conference of the Parties adopted the following decisions that had been recommended for adoption by the SBI:

- Division of labour between the Subsidiary Body for Implementation and the Subsidiary Body for Scientific and Technological Advice (decision 13/CP.3)
- Communications from Parties included in Annex I to the Convention (decision 6/CP.3)
- Volume of documentation (decision 18/CP.3)
- Review of the financial mechanism (decision 11/CP.3)
- Annex to the Memorandum of Understanding on the determination of funding necessary and available for the implementation of the Convention (decision 12/CP.3)
- Financial performance of the Convention in the biennium 1996-1997 (decision 16/CP.3)
- Arrangements for administrative support to the Convention secretariat (decision 17/CP.3)

For the texts of these decisions, see Part Two, section I, of this report.

51. At the 5th plenary meeting, on 5 December, the Conference of the Parties took note of document FCCC/CP/1997/INF.3 on secretariat activities relating to technical and financial support to Parties and document FCCC/CP/1997/INF.1 entitled, "Programme budget of the Convention for the biennium 1998-1999: detailed subprogramme activities and resource requirements".

52. At the 12th plenary meeting, on 11 December, the Conference of the Parties considered a draft decision on the programme budget for the biennium 1998-1999, submitted by the Chairman of the SBI on the basis of his informal consultations (FCCC/CP/1997/L.8). The Executive Secretary, welcoming the incorporation of additional resources for activities related to the Kyoto

Protocol, stated that the secretariat would need to look at the question of how to integrate those activities into its work programme, in particular in respect of the tasks listed in decision 1/CP.3 on the adoption of the Kyoto Protocol, for which preparatory work was needed for consideration by the Conference of the Parties at its fourth session. The Conference of the Parties noted the statement by the Executive Secretary and adopted decision 15/CP.3 on the programme budget for the biennium 1998-1999. For the text of this decision, see Part Two, section I, of this report.

3. Reports of the Ad Hoc Group on the Berlin Mandate

(Agenda item 3 (a) (iii))

53. At the 2nd plenary meeting, on 1 December, the Chairman of the Ad Hoc Group on the Berlin Mandate introduced the reports of the AGBM on the work of its fourth, fifth, sixth, seventh and the first part of its eighth sessions, contained in documents FCCC/AGBM/1996/8 and 11, FCCC/AGBM/1997/3 and Add.1 and Add.1/Corr.1, and FCCC/AGBM/1997/5 and 8, respectively. The final results of the work of the AGBM on a protocol or another legal instrument, as approved by the AGBM at the first part of its eighth session, were contained in the revised text under negotiation (FCCC/CP/1997/2).

54. The Chairman of the AGBM then listed a number of issues which the AGBM had not been able to address fully, and which he had undertaken to bring to the attention of the Conference of the Parties. They included the methodologies to be used to estimate emissions by sources and removals by sinks in the new instrument; preparations for the first meeting of the Parties to the Protocol; elements of a proposal submitted by Brazil and contained in document FCCC/AGBM/1997/MISC.1/Add.3, including a proposed methodology to measure emissions over a period of time in terms of their effect on temperature increase; and the future development of the commitments of all Parties.

55. At the same meeting, the Conference of the Parties took note of the above-mentioned reports of the AGBM, together with the oral report of the Chairman, and expressed its appreciation to Mr. Raúl Estrada-Oyuela (Argentina), Chairman of the AGBM, for his dedicated efforts and his noteworthy contribution to the Berlin Mandate process.

56. At the 5th plenary meeting, on 5 December, the Conference of the Parties took note of the report of the AGBM on the work of the second part of its eighth session (FCCC/AGBM/1997/8/Add.1).

4. Reports of the Ad Hoc Group on Article 13

(Agenda item 3 (a) (iv))

57. At its 2nd plenary meeting, on 1 December, the Conference of the Parties, having heard a report on the work of the Ad Hoc Group on Article 13 from its Chairman, took note with appreciation of the reports of the Ad Hoc Group on its third, fourth and fifth sessions (FCCC/AG13/1996/4 and FCCC/AG13/1997/2 and 4) and, pursuant to the recommendation of the Ad Hoc Group at its fifth session, adopted decision 14/CP.3 on the future work of the Ad Hoc Group on Article 13. For the text of this decision, see Part Two, section I, of this report.

B. Development and transfer of technologies
(Agenda item 3 (b))

58. In introducing this sub-item at the 3rd plenary meeting, on 3 December, the President recalled that the Conference of the Parties had already adopted decision 11/CP.3 on the development and transfer of technologies under sub-item 3 (i) (a) (see paragraphs 46 and 47 above). He noted that, at the request of the Conference of the Parties at its second session, the secretariat had organized a round table on the transfer of technologies and know-how, to be held on the morning of Tuesday, 9 December. A short report on that round table would be made available as a conference room paper.

59. Statements were made under this sub-item by the representatives of eight Parties, including one speaking on behalf of the Group of 77 and China. The President indicated that the subject of the development and transfer of technologies would continue to be under consideration by the SBSTA and the SBI, and would be taken up again by the Conference of the Parties at its fourth session.

60. At the 12th plenary meeting, on 11 December, a representative of the secretariat introduced the report on the round table, which had been circulated under the symbol FCCC/CP/1997/CRP.5.

C. Financial mechanism: report of the Global Environment Facility to the Conference
(Agenda item 3 (c))

61. At the 3rd plenary meeting, on 3 December, the Chief Executive Officer and Chairman of the Global Environment Facility (GEF) made a statement introducing the report of the Global Environment Facility to the Conference of the Parties at its third session (FCCC/CP/1997/3). Statements were made by representatives of 14 Parties, including one speaking on behalf of the Group of 77 and China and one speaking on behalf of the European Community and its member States. The Chief Executive Officer and Chairman of the GEF responded to a number of questions raised in those statements. At the same meeting, the Conference of the Parties expressed its appreciation to the Council of the GEF and took note of the above-mentioned report.

D. Second review of the adequacy of Article 4.2(a) and (b)
(Agenda item 3 (d))

62. In introducing this sub-item at the 3rd plenary meeting, on 3 December, the President recalled that the Conference of the Parties had reviewed Article 4.2(a) and (b) of the Convention at its first session and, having considered that the sub-paragraphs were not adequate, the Conference had agreed, in its decision 1/CP.1 on the Berlin Mandate, to begin a process to enable it to take appropriate action for the period beyond the year 2000, including the strengthening of the commitments of Annex I Parties in Article 4.2(a) and (b) through the adoption of a protocol or another legal instrument at its third session. Article 4.2(d) provided that a second review of

Article 4.2(a) and (b) should take place not later than 31 December 1998, and thereafter at regular intervals determined by the Conference of the Parties, until the objective of the Convention was met. The SBI at its sixth session had requested the secretariat to make all necessary preparations for the Conference of the Parties at its third session to consider the second review of the adequacy of Article 4.2(a) and (b), and had invited the Conference of the Parties to place the second review on the agenda for its fourth session.

63. Statements were made under this sub-item by representatives of six Parties, including one speaking on behalf of the Alliance of Small Island States and one speaking on behalf of the European Community and its member States. At the same meeting, the Conference of the Parties decided to place the issue of the second review of the adequacy of Article 4.2(a) and (b) on the agenda for its fourth session, and to request the subsidiary bodies and the secretariat to make all necessary preparations to facilitate future consideration of that item.

E. Review of information and possible decisions under Article 4.2(f)

(Agenda item 3 (e))

64. In introducing this sub-item at the 3rd plenary meeting, on 3 December, the President recalled that Article 4.2(f) of the Convention provided that the Conference of the Parties should review, not later than 31 December 1998, available information with a view to taking decisions regarding such amendments to the lists in Annexes I and II as might be appropriate, with the approval of the Party concerned. The Executive Secretary informed the Conference of the Parties that there were three Parties that had indicated that they wished to be included in Annex I to the Convention: Croatia, the Czech Republic and Slovakia. The latter two Parties had requested that the name of Czechoslovakia be deleted from Annex I the Convention, and that their names should be included in its place. Turkey, which was not yet a party to the Convention, had requested the deletion of its name from Annex I and Annex II to the Convention. A submission by Turkey was before the Conference of the Parties in document FCCC/CP/1997/MISC.3.

65. At the same meeting, the representative of Slovenia informed the Conference of the Parties that his country had notified the Depositary, under Article 4.2(g), of its intention to be bound by Article 4.2(a) and (b) of the Convention.

66. After an exchange of views, in which statements were made by representatives of 11 Parties, including one speaking on behalf of the European Community and its member States, and of one observer State, it was agreed that Mr. Luis Herrera Marcano, Vice-President of the Conference, should hold informal consultations on this sub-item and report back to the plenary of the Conference.

67. At the 5th plenary meeting, on 5 December, Mr. Luis Herrera Marcano, Vice-President of the Conference, reported on the outcome of his consultations and submitted a draft decision relating to the deletion of Czechoslovakia from the list of Parties included in Annex I to the Convention, and the inclusion of Croatia, the Czech Republic, Slovakia and Slovenia in that list (FCCC/CP/1997/L.3). He noted that the names of those countries should be followed by the footnote reference a/, which would link their names to the footnote to Annex I reading "Countries

that are undergoing the process of transition to a market economy." It had not yet proved possible to reach a consensus with regard to the deletion of the name of Turkey from the lists in Annexes I and II to the Convention, and he requested authorization to pursue his consultations on that question.

68. At its 12th plenary meeting, on 11 December, the Conference of the Parties considered an amendment to that decision, submitted by the Vice-President (FCCC/CP/1997/L.3/Add.1), adding the names of Monaco and Liechtenstein to the list of Parties included in Annex I to the Convention, together with a number of oral amendments. It then adopted decision 4/CP.3 on amendments to the list in Annex I to the Convention under Article 4.2(f) of the Convention, the text of which is contained in Part Two, section I, of this report. At the same meeting, it also requested the SBI, at its eighth session, to consider the request to delete the name of Turkey from the lists in Annexes I and II to the Convention, and to present a report to the Conference of the Parties at its fourth session for consideration and definitive action.

F. Other matters relating to implementation

(Agenda item 3 (f))

69. At its 5th plenary meeting, on 5 December, the Conference of the Parties, on the proposal of the President, decided that the proposal presented by Brazil in document FCCC/AGBM/1997/MISC.1/Add.3 should be referred to the SBSTA for its advice regarding the methodological and scientific aspects. It authorized the SBSTA to seek inputs, as appropriate, from its roster of experts and from the IPCC, and requested it to make its advice available to the Conference of the Parties at its fourth session. The representative of Brazil made a statement in connection with that decision.

70. At the same meeting, the representative of New Zealand introduced a proposal relating to the future commitments of all the Parties. Statements were made in that connection by 46 Parties, including one speaking on behalf of the Group of 77 and China, one speaking on behalf of the European Community and its member States, one speaking on behalf of the Southern African Development Commission, and one speaking on behalf of the Arab States. The President then informed the Conference of the Parties that, in view of the wide divergence of views expressed, he would consult further with the Bureau on how to deal with the matter.

IV. AMENDMENTS TO THE CONVENTION AND ITS ANNEXES

(Agenda item 4)

71. For its consideration of this item, the Conference of the Parties had before it a note by the secretariat entitled "Amendments to the Convention or its Annexes" (FCCC/SBI/1997/15), containing a proposal by Pakistan and Azerbaijan for the deletion of Turkey from the lists in Annexes I and II to the Convention, an amendment to Article 17 proposed by the Netherlands on behalf of the European Community and its member States, and an amendment to Article 4.3 proposed by Kuwait. At the 4th plenary meeting, on 3 December, statements were made on this item by representatives of 11 Parties, including one speaking on behalf of the European Community and its member States.

A. Proposal to amend Article 4.3

(Agenda item 4 (a))

72. At the 4th plenary meeting, on 3 December, it was agreed that Mr. Bakary Kante, the Chairman of the SBI, should hold informal consultations on the proposed amendment to Article 4.3, and to report back to the plenary of the Conference on the results of those consultations.

73. At the 5th plenary meeting, on 5 December, the Chairman of the SBI reported that, as it had not proved possible to arrive at a consensus on the proposed amendment, Kuwait had agreed not to pursue its proposal. The representative of Kuwait made a statement confirming that his delegation was willing to withdraw its proposed amendment. The Conference of the Parties noted that the proposal to amend Article 4.3 had been withdrawn.

B. Proposal to amend Article 17

(Agenda item 4 (b))

74. At the 4th plenary meeting, on 3 December, it was agreed that Mr. Sergio Zelaya Bonilla, Vice-President of the Conference, should hold informal consultations on the proposed amendment to Article 17, and to report back to the plenary of the Conference on the results of those consultations.

75. At the 5th plenary meeting, on 5 December, the Vice-President reported that it had not proved possible to arrive at a consensus on the proposed amendment. The representative of the Netherlands, on behalf of the European Community and its member States, stated that, in light of the results of the informal consultations, the European Community and its member States would not pursue its proposal. The Conference of the Parties noted that the proposal to amend Article 17 had been withdrawn.

C. Proposal to amend Annexes I and II
(Agenda item 4 (c))

76. At the 4th plenary meeting, on 3 December, the President noted that this proposal was being dealt with under sub-item 3 (e). For the action taken on this sub-item, see paragraphs 67-68 above.

V. ADOPTION OF A PROTOCOL OR ANOTHER LEGAL INSTRUMENT: FULFILMENT OF THE BERLIN MANDATE

(Agenda item 5)

77. At its 2nd plenary meeting, on 1 December, the Conference of the Parties had allocated consideration of this agenda item to the Committee of the Whole (see paragraph 30 above). At the 5th plenary meeting, on 5 December, the Chairman of the Committee of the Whole made an interim report on the state of the negotiations in the Committee on the draft protocol. Three negotiating groups had been established to deal with specific elements of the text. The first, chaired by Mr. Takao Shibata (Japan), was dealing with the Articles relating to institutions and mechanisms; the second, co-chaired by Mr. John Ashe (Antigua and Barbuda) and Mr. Bo Kjellén (Sweden), was dealing with the Articles on continuing to advance the implementation of existing commitments in Article 4.1 of the Convention and the financial mechanism; and the third, chaired by Mr. Mohamed M. Ould El Ghaouth (Mauritania), was dealing with policies and measures. He himself was conducting negotiations on matters relating to quantified emission limitation and reduction objectives (QELROs). In addition to those negotiating groups, he, and some of the chairmen of the negotiating groups, had requested several delegates to conduct informal consultations on specific issues. The intensive negotiations currently under way were advancing and were beginning to yield results, but the Committee of the Whole would need additional time to resolve many of the outstanding issues so that only a few, key issues would remain for the consideration of ministers during the high-level segment.

78. At the 12th plenary meeting, on 11 December, the Chairman of the Committee of the Whole reported on the outcome of the work of the Committee. The Committee of the Whole had unanimously recommended, for adoption by the Conference of the Parties, a draft decision on the adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (FCCC/CP/1997/L.7), to which the text of the Protocol (FCCC/CP/1997/L.7/Add.1) was annexed. It had also recommended a draft decision on methodological issues related to the Kyoto Protocol (FCCC/CP/1997/L.5) and a draft decision on the implementation of Article 4, paragraphs 8 and 9, of the Convention (FCCC/CP/1997/L.9). The Committee had further recommended that, for the purposes of Article 25 of the Protocol relating to entry into force, a table indicating the total carbon dioxide emissions of Annex I Parties in 1990, to be prepared on the basis of secretariat documents relating to first national communications, should be annexed to the report of the Conference.

79. The President, on behalf of the Conference, expressed his great appreciation of the work accomplished by the Committee of the Whole and paid tribute to the Chairman of that Committee for his untiring efforts and the leadership he had shown throughout the negotiating process. He also thanked the chairmen of the negotiating groups and all those who had assisted the Chairman in the formal and informal consultations.

80. On the advice of the Chairman of the Committee of the Whole, the President proposed an oral amendment to the draft decision on adoption of the Kyoto Protocol contained in FCCC/CP/1997/L.7, adding a further sub-paragraph to operative paragraph 5 of the draft decision. In the ensuing discussion, the representative of a Party suggested an alternative

formulation of the additional sub-paragraph; on the advice of the Chairman of the Committee of the Whole, the President did not propose this text for adoption. Some technical corrections to the text of the Kyoto Protocol were proposed orally and accepted by the President; these deleted paragraph 11 of Article 12 and footnote 1 in Annex B and amended the title of a column in that Annex. The Executive Secretary requested Parties to submit any further technical corrections in writing to the secretariat, so that the final authentic texts of the Protocol could be completed in time for its opening for signature on 16 March 1998.

81. The Conference of the Parties then proceeded to adopt decision 1/CP.3 entitled "Adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change", including the oral amendment proposed by the President, thereby adopting the said Protocol which was annexed to that decision. At the same meeting, the Conference also adopted decision 2/CP.3 on methodological issues related to the Kyoto Protocol and decision 3/CP.3 on implementation of Article 4, paragraphs 8 and 9, of the Convention. For the texts of these decisions, see Part Two, section I, of this report. The Conference of the Parties further decided that, for the purposes of Article 25 of the Protocol relating to entry into force, a table indicating the total carbon dioxide emissions of Annex I Parties in 1990, to be prepared on the basis of secretariat documents relating to first national communications, should be annexed to the report of the Conference (see the annex to Part Two of this report).

82. The representative of Luxembourg, speaking on behalf of the European Community and its member States, stated that the European Community and its member States would implement their respective commitments under Article 3, paragraph 1, of the Protocol, in accordance with the provisions of Article 4 of the Protocol.

83. The representative of Trinidad and Tobago, speaking on behalf of the Alliance of Small Island States (AOSIS), recalled that three years had elapsed since AOSIS had first proposed the adoption of a protocol to the Convention which would strengthen the commitments of Annex I Parties and would be capable of sending strong and clear signals to the market place. The reductions agreed upon as a result of the compromises reached in the Kyoto Protocol were inadequate to meet the message of science and the emissions allowed to some countries were, in his view, morally questionable. No country should be allowed to buy its reductions and those Parties which had come to Kyoto prepared to accept greater reductions than those eventually agreed upon should continue their efforts to achieve maximum reductions. Many methodological and scientific uncertainties remained and resources would be needed to tackle them. The aspirations of AOSIS had been largely frustrated and Parties should be prepared to return next year with a clearer purpose, in the knowledge that future generations would have to pay the price of the compromises reached today.

VI. HIGH-LEVEL SEGMENT ATTENDED BY MINISTERS AND OTHER HEADS OF DELEGATION

(Agenda item 6)

84. At the opening of the high-level segment at the 6th plenary meeting, on 8 December, the Conference of the Parties was addressed by Mr. Ryutaro Hashimoto, Prime Minister of Japan; Mr. José María Figueres Olsen, President of Costa Rica; Mr. Kinza Clodumar, President of Nauru; Mr. Albert Gore, Jr., Vice President of the United States of America and President of the Senate; and Mr. Maurice F. Strong, representative of the Secretary-General of the United Nations, who delivered a message to the Conference of the Parties on behalf of the Secretary-General.

85. Statements were made by the President of the Conference and by the Executive Secretary at the opening of the general debate. The general debate was held during the 6th, 7th, 8th, 9th, 10th and 11th plenary meetings, on 8 and 9 December. During that debate, statements were made by 124 ministers and other heads of delegation of Parties, by a minister from one observer State, and by representatives of 5 United Nations offices and programmes, 10 specialized agencies and other organizations of the United Nations system, 6 intergovernmental organizations and 12 non-governmental organizations. For the list of speakers in the general debate, see annex I below.

VII. CONCLUSION OF THE SESSION

(Agenda item 8)

A. Adoption of the report of the Conference of the Parties on its third session

(Agenda item 8 (a))

86. At its 12th plenary meeting, on 11 December, the Conference of the Parties adopted the draft report on its third session (FCCC/CP/1997/L.4) and authorized the Rapporteur, with the assistance of the secretariat, to complete the report as appropriate.

B. Closure of the session

(Agenda item 8(b))

87. At its 12th plenary meeting, on 11 December, the Conference of the Parties, having considered a draft resolution submitted by Bhutan (FCCC/CP/1997/L.6), adopted resolution 1/CP.3 entitled "Expression of gratitude to the Government and people of Japan". For the text of this resolution, see Part Two, section II, of this report.

88. Closing statements were made by the representatives of the United States of America, Luxembourg (on behalf of the European Community and its member States), the United Republic of Tanzania (on behalf of the Group of 77 and China) and Japan. A statement was made by the Executive Secretary.

89. The President, after making a closing statement in which he thanked all participants for their constructive cooperation in the negotiations, declared the third session of the Conference of the Parties closed.

Annex I

Statements by ministers and by other representatives during the high-level segment of the third session of the Conference of the Parties: list of speakers

I. Parties to the Convention

		Plenary meeting
Albania	Mr. Maksim Deliana Chairman of the Environmental Protection Committee	8
Algeria	Mr. Bachir Amrat Minister of Environment	10
Argentina	Ms. Maria Julia Alsogaray Secretary for Natural Resources and Human Environment	6
Armenia	Mr. Sarkis Shahazizyan Minister of Nature Protection	10
Australia	Mr. Robert Hill Minister for the Environment	6
Austria	Dr. Martin Bartenstein Federal Minister for the Environment, Youth and Family Affairs	9
Azerbaijan	Mr. Zulfugar Musayev Minister of State responsible for Hydrometeorology and Environment	10
Bahrain	Mr. Khalid M. Fakhro Director-General, Environmental Affairs	11
Bangladesh	Begum Syeda Sajeda Chowdhury Minister for Environment and Forests	7

		Plenary meeting
Barbados[a]	Ms. Elizabeth Thompson Minister of Environment and Health	7
Belgium	Mr. Jan Peeters Federal Minister of the Environment	9
Bhutan	Mr. Dasho Paljor J. Dorji Deputy Minister for Environment	11
Bolivia	Ms. Neisa Roca Hurtado Deputy Minister of Sustainable Development and the Environment	8
Botswana	Mr. Daniel K. Kwelagobe Minister of Works, Transport and Communications	8
Brazil	Mr. José Israel Vargas Minister for Science and Technology	7
Bulgaria	Ms. Evdokia Maneva Minister of Environment and Water	10
Cambodia	Dr. Mok Mareth Minister, Ministry of Environment	10
Canada	Ms. Christine Stewart Minister of the Environment	7
Chile	Mr. Rolando Stein Ambassador, Director of Environment Ministry of Foreign Affairs	11
China	Mr. Yaobang Chen Minister of Forestry and Vice-Chairman of the State Planning Commission	7
Colombia	Mr. Eduardo Verano de la Rosa Minister for the Environment	9

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[a] Speaking also on behalf of the Caribbean Community.

		Plenary meeting
Costa Rica	Mr. José María Figueres Olsen President	6
Côte d'Ivoire	Mr. Albert K. Tiapani Minister for Housing, the Quality of Life and the Environment	10
Croatia	Dr. Ljerka Mintas Hodak Deputy Prime Minister	9
Cuba	Dr. Rosa Elena Simeón Negrín Minister of Science, Technology and the Environment	9
Czech Republic	Mr. Vadislav Bizek Deputy Minister of the Environment	10
Denmark	Mr. Svend Auken Minister of Environment and Energy	7
Ecuador	Mr. Juan Salazar Sancisi Ambassador of Ecuador to Japan	11
Egypt	Ms. Nadia Riad Mekram Ebeid State Minister for the Environment	9
Eritrea	Mr. Tekleab Mesghina Director-General, Department of the Environment, Ministry of Land, Water and the Environment	11
Estonia	Mr. Villu Reiljan Minister of the Environment	10
Ethiopia	Mr. Shiferaw Jarso Minister of Water Resources	10
European Community	Ms. Ritt Bjerregaard Environment Commissioner	7

		Plenary meeting
Fiji	Mr. Seremaia Cavuilati Ambassador of Fiji to Japan Development, Housing and Environment	11
Finland	Mr. Pekka Haavisto Minister of the Environment	9
France	Ms. Dominique Voynet Minister of Physical Planning and the Environment	6
Gambia	Captain Edward Singhatey Secretary of State for Presidential Affairs, Fisheries and Natural Resources	10
Georgia	Ms. Nino Chkhobadze Environment Protection Minister	8
Germany	Dr. Angela Merkel Federal Minister for the Environment, Nature Conservation and Nuclear Safety	7
Ghana	Mr. J. E. Afful Minister for the Environment, Science and Technology	9
Greece	Mr. Theodoros Koliopanos Deputy Minister for the Environment, Physical Planning and Public Works	8
Honduras[b]	Mr. Sergio Alejandro Zelaya Bonilla Vice-Minister of the Environment Ministry of Natural Resources and the Environment	8
Hungary	Dr. Katalin Szili Secretary of State for the Environment	7

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[b] Speaking also on behalf of the Central American countries of Belize, Costa Rica, El Salvador, Guatemala, Nicaragua and Panama.

		Plenary meeting
Iceland	Mr. Gudmundur Bjarnason Minister for the Environment	7
India	Prof. Saifuddin Soz Minister for Environment and Forests	6
Indonesia	Mr. Sarwono Kusumaatmadja State Minister for Environment	7
Iran (Islamic Republic of)	Dr. Masoumeh Ebtekar Vice-President and Director of the Department of Environment	6
Ireland	Mr. Noel Dempsey Minister for the Environment and Local Government	9
Italy	Mr. Edo Ronchi Minister for Environment	9
Japan	Mr. Ryutaro Hashimoto Prime Minister	6
	Mr. Keizo Obuchi Minister for Foreign Affairs	6
	Mr. Mitsuo Horiuchi Minister for International Trade and Industry	6
Jordan	Mr. Farouk Kasrawi Ambassador of Jordan to Japan	11
Kazakhstan	Mr. Serikbek Daukeev Minister of Ecology and Natural Resources	9
Kenya	Mr. William P. Mayaka Permanent Secretary Ministry of Environment and Natural Resources	11
Kiribati	Mr. Tewareka Borau Minister for Environment and Social Development	10

		Plenary meeting
Kuwait	Dr. Mohammad Abderrahman Al-Saraawi Chairman of the Board and Director-General of the Public Authority for Environment	8
Lao People's Democratic Republic	Prof. Souli Nanthavong Minister, President of Science and Technology and Environment Organization	10
Latvia	Mr. Indulis Emsis State Minister for the Environment, Ministry of Environment Protection and Regional Development	9
Lebanon	Mr. Samir Chamma Ambassador of Lebanon to Japan	11
Lesotho	Mrs. H. M. Mhlanga Principal Secretary, Ministry of Natural Resources	11
Lithuania	Mr. Imantas Lazdinis Environmental Protection Minister	8
Luxembourg[c]	Dr. Johny Lahure Minister of the Environment	6
Malawi	Mr. Mayinga Mkandawire Minister for Forestry, Fisheries and Environmental Affairs	10
Malaysia	Datuk Law Hieng Ding Minister of Science, Technology and the Environment	7
Maldives	Mr. Abdul Rasheed Hussain Minister of Planning, Human Resources and Environment	7

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[c] Speaking also on behalf of the European Community and its member States.

		Plenary meeting
Malta	Mr. Saviour F. Borg Permanent Representative of Malta to United Nations Environment Programme, Ministry of Foreign Affairs and the Environment	11
Mauritius	Mr. James Burty David Minister of Local Government and Environment	10
Mexico	Ms. Julia Carabias Lillo Secretary, Environment, Natural Resources and Fisheries	7
Micronesia (Federated States of)	Mr. Leo A. Falcam Vice-President	9
Monaco	Mr. Bernard Fautrier Minister Plenipotentiary	10
Mongolia	Mr. Tsokhio Adyasuren Minister for Nature and Environment	8
Morocco	Mr. Lahoucine Tijani Secretary of State to the Minister for Agriculture, Works and the Environment	10
Mozambique	Mr. Bernardo Ferraz Minister for Coordination of Environmental Affairs	8
Myanmar	Mr. U Soe Win Ambassador of Myanmar to Japan	11
Nauru	Mr. Kinza Clodumar President	6
Netherlands	Mrs. Margaretha de Boer Minister of Housing, Spatial Planning and Environment	7
New Zealand	Mr. Simon Upton Minister for the Environment	7

		Plenary meeting
Niger	Mr. Kimba Hassane Adviser, Executive Secretariat, National Council on the Environment for Sustainable Development	11
Nigeria	Dr. Adegoke Adegoroye Director-General, Chief Executive, Federal Environmental Protection Agency	8
Niue	Mr. Terry Donald Coe Minister for Post and Telecommunications, Meteorological Services and Climate Change, Agriculture, Fisheries and Forestry	8
Norway	Ms. Guro Fjellanger Minister of Environment	7
Pakistan	Mr. Mujahid Husain Ambassador of Pakistan to Japan	8
Papua New Guinea	Mr. Aiwa Olmi Ambassador of Papua New Guinea to Japan	8
Paraguay	Dr. Miguel Angel Solano López Ambassador Extraordinary and Plenipotentiary of Paraguay to Japan	8
Peru	Ms. Agnes Franco Deputy Minister for Industry	11
Philippines	Mr. Victor O. Ramos Secretary, Department of Environment and Natural Resources	9
Poland	Mr. Radoslaw Gawlik Secretary of State Ministry of Environmental Protection, Natural Resources and Forestry	11
Portugal	Dr. Elisa Ferreira Minister of Environment	8

		Plenary meeting
Qatar	Mr. Ali Ben Saeed Al Khayaren Ministry of Municipality Affairs and Agriculture	8
Republic of Korea	Mr. Yeo-Joon Yoon Minister of Environment	7
Republic of Moldova	Mr. Sergiu Fandofan Minister for Environmental Protection	8
Romania	Mr. Eugen Dijmarescu Ambassador of Romania to Japan	11
Russian Federation	Mr. Alexander J. Bedritsky Head of the Federal Service for Hydrometeorology and Environmental Monitoring	6
Samoa[d]	Mr. Tuala Sale Tagaloa Minister of Lands, Survey and Environment	6
Saudi Arabia	Prince Fahad Bin Abdallah Al-Saud Assistant of the Minister for Defense and Aviation and Inspector-General for Civil Aviation	7
Senegal	Mr. P. Abdoulaye Bathily Minister of Environment	9
Seychelles	Mr. Dolor Ernesta Minister for Community Development	8
Singapore	Mr. Yeo Cheow Tong Minister for the Environment	9
Slovakia	Mr. Jozef Zlocha Minister of Environment	10
Slovenia	Dr. Pavel Gantar Minister of Environment and Physical Planning	9

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[d] Speaking also on behalf of the Alliance of Small Island States.

		Plenary meeting
Solomon Islands	Mr. Patteson Oti Minister for Foreign Affairs and Trade Relations	10
South Africa	Mr. Peter Mokaba Deputy Minister of Environmental Affairs and Tourism	8
Spain	Ms. Isabel Tocino Minister for the Environment	7
Sudan	Mr. Mohamed El Kadir Abdalla Director, Meteorology General Corporation	11
Swaziland	Mr. Mduduzi Magongo Principal Secretary for Tourism, Environment and Communications	11
Sweden	Ms. Anna Lindh Minister of the Environment	6
Switzerland	Ms. Ruth Dreifuss Federal Councillor, Head of the Federal Department of Home Affairs	6
Syrian Arab Republic	Mr. Abdul Hamid El-Munajed Minister of Environment	8
Thailand	Mr. Porntep Techapaibul Deputy Minister of Science, Technology and Environment	11
Togo	Mr. Komlavi Yao Minister of Environment and Forest Resources	9
Tunisia	Mr. Salah Hannachi Ambassador of Tunisia to Japan	10
Turkmenistan	Mr. Ovezmurat G. Annaev Deputy Minister, Head of Turkmenglavhydromet	10

		Plenary meeting
Tuvalu	Sir Toaripi Lauti Prime Minister's Special Envoy on Climate Change	8
Uganda	Mr. Bwango Apuuli Department of Meteorology The Ministry of Natural Resources	11
Ukraine	Mr. Yuri Kostenko Minister for Environmental Protection and Nuclear Safety	8
United Arab Emirates	Mr. Hamad Abdul Rahman Al Madfa Minister of Health and Chairman of the Federal Environmental Agency	9
United Kingdom of Great Britain and Northern Ireland	Mr. John Prescott, MP Deputy Prime Minister and Secretary of State for the Environment, Trade and the Regions	6
United Republic of Tanzania[e]	Mr. Bakari Mbonde Minister of State, Vice-President's Office of the United Republic of Tanzania	6
United States of America	Mr. Albert Gore, Jr. Vice President	6
Uruguay	Mr. Juan Gabito Zoboli Under-Secretary, Ministry of Housing, Physical Planning and the Environment	11
Uzbekistan	Dr. Victor E. Chub Minister, Chief of Glavgidromet	7
Vanuatu	Mr. Demis Lango Minister of Civil Aviation	8
Venezuela	Mr. Erwin Arrieta Minister of Energy and Mines	6

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[e] Speaking also on behalf of the Group of 77 and China.

		Plenary meeting
Viet Nam	Prof. Nguyen Duc Ngu Director-General, Hydrometeorological Service Chairman of the Environment Protection Council	11
Yemen	Mr. Mohsen Al-Hamdani Chairman of the Environment Protection Council	10
Zambia	Mr. William J. Harrington Minister of Environment and Natural Resources	9
Zimbabwe	Mr. Simon Khaya Moyo Minister of Mines, Environment and Tourism	9

II. Observer State

Turkey	Ms. Imren Aykut Minister of Environment	9

III. United Nations offices and programmes

United Nations	Mr. Maurice Strong Representative of the Secretary-General	6
	Mr. Nitin Desai Under-Secretary-General for Economic and Social Affairs	6
United Nations Economic and Social Commission for Asia and the Pacific	Mr. Rezaul Karim Chief, Environment Section, Environment and Natural Resources Management Division	11
United Nations Development Programme	Mr. Anders Wijkman Assistant Administrator Director, Bureau for Development Policy	10
United Nations Environment Programme	Ms. Elizabeth Dowdeswell Executive Director	7

		Plenary meeting
World Food Programme	Mr. Tun Myat Director, Resources and External Relations Division	11
Convention to Combat Desertification	Mr. Hama Arba Diallo Executive Secretary	10

IV. Specialized agencies and other organizations of the United Nations system

United Nations Educational, Scientific, and Cultural Organization	Mr. Gisbert Glaser Director, Bureau for Coordination of Environmental Programmes	11
Intergovernmental Oceanographic Commission	Mr. Gunnar Kullenberg Executive Secretary	11
International Civil Aviation Organization	Mr. John Crayston Coordinator, Air Transport and Environment Programmes	11
World Bank	Mr. Caio Koch-Weser Managing Director	7
Global Environment Facility	Mr. Mohamed T. El-Ashry Chief Executive Officer and Chairman	9
World Meteorological Organization	Prof. G.O.P. Obasi Secretary-General	7
Intergovernmental Panel on Climate Change	Mr. Robert Watson Chairman	9
United Nations Industrial Development Organization	Mr. Robert O. Williams Senior Industrial Development Officer, Environment and Energy Branch	11
International Atomic Energy Agency	Mr. Hans Holger Rogner Head, Planning and Economic Studies Section	11

V. Intergovernmental organizations

		Plenary meeting
Asian Development Bank	Mr. Kazi Jalal Chief, Office of Environment and Social Development	11
European Bank for Reconstruction and Development	Mr. William V. Kennedy Senior Environmental Specialist	11
International Energy Agency	Mr. Robert Priddle Executive Director	9
Organization of the Petroleum Exporting Countries	Mr. Rilwanu Lukman Secretary-General	10
Permanent Commission for the South Pacific	Mr. Nicolas Roncagliolo Higueras Secretary-General	11
South Pacific Regional Environment Programme	Mr. Gerald Miles Head, Environmental Management and Planning Division	11

VI. Non-governmental organizations

Climate Action Network, South East Asia	Mr. Gurmit Singh Coordinator	9
Global Legislators Organisation for a Balanced Environment	Mr. Tom Spencer President	9
International Chamber of Commerce	Mr. Yoshifumi Tsuji Vice-Chairman Japan Federation of Economic Organizations	10
International Confederation of Free Trade Unions	Mr. Stephen Pursey Head, Economic and Social Policy Department	11
International Council for Local Environmental Initiatives	Mr. Takehisa Matsubara Mayor of the City of Nagoya, Japan	6

		Plenary meeting
International Federation of Chemical, Energy, Mine and General Workers' Unions	Mr. Kenneth S. Zinn North American Regional Coordinator,	11
International Youth and Student Movement for the United Nations	Mr. Hirofumi Goto	10
Scientists for Global Responsibility[f]	Ms. Michele Valentine	11
The Business Council for Sustainable Energy	Mr. Michael Marvin Executive Director	10
United States Climate Action Network	Ms. Jennifer Morgan Coordinator	10
World Business Council for Sustainable Development	Mr. Egil Myklebust President and Chief Executive Officer of Norsk Hydro, Norway	9
World Council of Churches	Mr. David Hallman Climate Change Programme Coordinator	11

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[f] Speaking on behalf of "The Climate Train".

Annex II

List of intergovernmental and non-governmental organizations attending the third session of the Conference of the Parties

I. Intergovernmental organizations

1. Agency for Cultural and Technical Co-operation
2. Asian Development Bank
3. Caribbean Community Secretariat
4. Central American Commission on the Environment and Development
5. Commission for Environmental Cooperation
6. European Bank for Reconstruction and Development
7. European Conference of Ministers of Transport
8. International Energy Agency
9. International Institute of Refrigeration
10. International Tropical Timber Organization
11. Organisation for Economic Co-operation and Development
12. Organization of the Petroleum Exporting Countries
13. Permanent Commission for the South Pacific
14. Ramsar Convention on Wetlands
15. South Pacific Regional Environment Programme

II. Non-governmental organizations[a]

1. A SEED Europe - Action for Solidarity, Equality, Environment and Development
2. A SEED Japan - Action for Solidarity, Equality, Environment and Development*
3. African Centre for Technology Studies
4. AIESEC Hitotsubashi Local Committee*
5. Alliance for Responsible Atmospheric Policy
6. Alliance for Responsible Environmental Alternatives
7. Alliance Internationale de Tourisme
8. American Federation of Labor and Congress of Industrial Organizations
9. American Portland Cement Alliance
10. American Society of International Law
11. Architectural Institute of Japan*
12. Association Française du Froid/Alliance Froid, Climatisation, Environnement
13. Association of International Research Initiatives for Environmental Studies*

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[a] The non-governmental organizations listed with an asterisk against their names were admitted only to the third session of the Conference of the Parties. Should they wish to continue to participate in the Convention process, they may reapply.

14. Association Tunisie Mediterranée Pour Le Développement Durable
15. Atmosphere Action Network in East Asia
16. Australian Aluminium Council
17. Australian Coal Association
18. Berne Declaration
19. Birdlife International
20. Business Council of Australia
21. Canadian Electricity Association
22. Canadian Global Change Program
23. Canadian Vehicle Manufacturers' Association
24. CEDARENA (Environmental and Natural Resources Law Centre)
25. Center for Clean Air Policy
26. Center for International and European Environmental Research (ecologic)
27. Center for International Climate and Environmental Research
28. Center for International Environmental Law
29. Center for Sustainable Development in the Americas
30. Central Research Institute of Electric Power Industry
31. Centre for Applied Studies in International Negotiations
32. Centre for Business and the Environment
33. Church of the Brethren
34. Citizens Alliance for Saving the Atmosphere and Earth
35. Citizens Environmental Foundation*
36. Citizens' Coalition for Economic Justice
37. Citizens' Nuclear Information Center*
38. Clean Energy and Environment Shimada*
39. Climate Action Network - Africa
40. Climate Action Network - Europe
41. Climate Action Network - Latin America
42. Climate Action Network - United Kingdom
43. Climate Action Network South Asia
44. Climate Action Network-Southeast Asia
45. Climate Institute
46. Columbia Earth Institute/Columbia University
47. Competitive Enterprise Institute
48. Confederación Sindical de Comisiones Obreras
49. Construction, Forestry, Mining and Energy Union
50. Development Alternatives
51. E & Co (An Energy Investment Service)
52. Earth Action
53. Earth Council
54. Earth Science and Technology Organization*
55. Ecosystem Conservation Society*
56. Edison Electric Institute
57. Energy 21

58. Environmental Defense Fund
59. Environment Information Center*
60. European Atomic Forum
61. European Business Council for a Sustainable Energy Future
62. European Environmental Bureau
63. European Insulation Manufacturers Association
64. European Round Table of Industrialists
65. European Science and Environment Forum
66. European Wind Energy Association
67. Federal Association of the German Industry
68. Forests Absorbing Carbondioxide Emisson
69. Foundation for International Environmental Law and Development
70. Franciscans International
71. Free University Berlin
72. Friends of the Earth - Japan*
73. Friends of the Earth International
74. German Advisory Council on Global Change
75. German NGO-Forum on Environment & Development
76. Germanwatch
77. Global Climate Coalition
78. Global Commons Institute
79. Global Dynamics Institute
80. Global Environment Centre Foundation*
81. Global Environment Forum-Kansai
82. Global Environmental Action*
83. Global Guardian Trust*
84. Global Industrial and Social Progress Research Institute
85. Global Legislators Organisation for a Balanced Environment
86. Global Network Class "Gakkos"*
87. Globe Japan*
88. Green Cross Japan*
89. Green Earth Organization
90. Green Fingers Society for Environment Protection
91. Green Korea United
92. Greenpeace International
93. GRIP Québec - University of Montréal
94. Industrial Technology Research Institute
95. Industrial Union Department (IUD), AFL-CIO
96. Information Agency of the German Power Plants
97. Institut de recherche sur l'environnement
98. Insurance Industry Initiative for the Environment, in association with UNEP
99. International Academy of the Environment
100. International Center for Environmental Technology Transfer*
101. International Chamber of Commerce

102. International Climate Change Partnership
103. International Confederation of Free Trade Unions
104. International Council for Local Environmental Initiatives
105. International Council of Environmental Law
106. International Council of Scientific Unions
107. International Education Resource and Innovation Centre*
108. International Federation of Chemical, Energy, Mine and General Workers' Unions
109. International Federation of Industrial Energy Consumers
110. International Gas Union
111. International Institute for Energy Conservation
112. International Lake Environment Committee Foundation*
113. International Network for Environmental Management
114. International NGO Forum for Ozone Layer Protection and Against Global Warming*
115. International Organization for Standardization
116. International Organization of Motor Vehicle Manufacturers
117. International Petroleum Industry Environmental Conservation Association
118. International Society of Doctors for the Environment
119. International Society on Optics Within Life Sciences
120. International Solar Car Federation
121. International Union of Producers and Distributors of Electrical Energy
122. International Union of Public Transport
123. International Women's Year Liaison Group*
124. International Youth and Student Movement for the United Nations
125. Interstate Natural Gas Association of America
126. IWMC World Conservation Trust
127. Japan Association of Environment Assessment*
128. Japan Atomic Industrial Forum Inc*
129. Japan Automobile Federation*
130. Japan Bicycle Promotion Institute*
131. Japan Center of International and Comparative Environmental Law*
132. Japan Environment Association*
133. Japan Environment Corporation*
134. Japan Environmental Technology Association*
135. Japan Federation of Bar Associations
136. Japan Federation of Economic Organizations (Keidanren)
137. Japan Flon Gas Association
138. Japan Industrial Conference for Ozone Layer Protection
139. Japan International Forestry Promotion and Cooperation Center*
140. Japan Save the Ozone Network Gunma*
141. JICHIRO (All Japan Prefectural and Municipal Workers Union)*
142. Kiko Forum '97*
143. Kitakyushu International Techno-Cooperative Association*
144. Korea Institute of Science & Technology Europe
145. Kyoto Junior Chamber Inc*

146. Kyoto University*
147. Lancaster University
148. Loss Prevention Council
149. Midwest Research Institute/National Renewable Energy Laboratory
150. National Association of Regulatory Utility Commissioners
151. National Association of State Fire Marshals
152. National Mining Association
153. National Wildlife Federation
154. Natural Resource Users' Group
155. Natural Resources Defense Council
156. Nature Conservation Society of Japan*
157. Netherlands Economic Institute
158. New Energy and Industrial Technology Development Organization
159. Nippon International Cooperation for Community Development*
160. Nord-Sud-Forum e.V./Global Cooperation Council
161. Northwest Pacific Area Environmental Cooperation Center*
162. Nuclear Energy Institute
163. OISCA-International, Tokyo
164. Öko-Institut (Institute for Applied Ecology)
165. Overseas Evaluation Cooperation Centre**
166. Ozone Action
167. Peoples' Forum 2001, Japan
168. Potsdam Institute for Climate Impact Research
169. Railway Technical Reseach Institute*
170. RainForest ReGeneration Institute
171. Real Link Kyoto
172. Redefining Progress
173. Research Centre on Global Warming of the Japan Development Bank*
174. Research Institute of Innovative Technology for the Earth*
175. Réseau Action Climat France
176. Resources for the Future
177. SAEI (SFC Alternative Energy Innovators)*
178. Saitama Forum for Environmental Education*
179. Save the Earth! Action 97*
180. Scientists for Global Responsibilty
181. Sierra Club of Canada
182. Society of Electric Vehicle*
183. Solar Electric Light Fund
184. Solar Net*
185. SOROPTIMIST International of the Americas Inc, of the Higashi Region*
186. Southern Research Institute
187. Sovereignty International
188. Stockholm Environment Institute
189. Tata Energy Research Institute

190. Tellus Institute
191. Thailand Environment Institute
192. The Aozora Foundation*
193. The Business Council for Sustainable Energy
194. The Business Roundtable
195. The Climate Council
196. The David Suzuki Foundation
197. The Energy Conservation Center, Tokyo
198. The European Association for the Promotion of Cogeneration
199. The Federation of Electric Power Companies
200. The Forum of Local Government Representatives for Contemplation on the Environment and Industry*
201. The Fridtjof Nansen Institute
202. The Global Environmental Forum*
203. The Institute for Global Environmental Strategies*
204. The Institute of Energy Economics*
205. The Japan Economic Research Institute*
206. The Japan Electrical Manufacturers' Association
207. The Japan Environmental Education Forum*
208. The Japan Gas Association*
209. The Japan Network for Earth Environment and Prevention Pollution*
210. The Japan Scientist Association*
211. The Korea Chamber of Commerce and Industry
212. The Local Grassroots Network of Citizens*
213. The Nature Conservancy
214. The Netherlands Energy Research Foundation
215. The Pacific Rim Consortium for Energy Combustion and the Environment
216. The Pollution Related Health Damage Compensation and Prevention Association*
217. The Rockefeller Foundation
218. The Royal Institute of International Affairs
219. The Solar Century
220. The Swiss Federal Institute for Environmental Science and Technology/Human Ecology Group
221. The Uranium Institute
222. The Woods Hole Research Center
223. Union of Concerned Scientists
224. Union of Industrial and Employers' Confederations of Europe
225. United Methodist Church/General Board of Church and Society
226. United Mine Workers of America
227. United Nations Environment Development - UK Committee
228. United Nations Student Association of Japan*
229. University of Kassel
230. University of Oslo
231. University of Utrecht - Faculty of Chemistry

232. US Climate Action Network
233. Verification Technology Information Centre
234. Wild Bird Society of Japan*
235. World Business Council for Sustainable Development
236. World Coal Institute
237. World Conference on Religion and Peace
238. World Council of Churches
239. World Energy Council
240. World Resources Institute
241. World Watch Institute
242. Wuppertal Institute for Climate, Environment and Energy
243. WWF-International

Annex III

List of documents before the Conference of the Parties at its third session

FCCC/CP/1996/2	Adoption of the rules of procedure
FCCC/CP/1997/1 and Add.1-2	Provisional agenda and annotations, including suggestions for the organization of work
FCCC/CP/1997/2 and Add.1	Adoption of a protocol or another legal instrument: Fulfilment of the Berlin Mandate. Revised text under negotiation
FCCC/CP/1997/3	Financial mechanism: report of the Global Environment Facility to the Conference of the Parties at its third session
FCCC/CP/1997/4	Admission of observers: intergovernmental and non-governmental organizations
FCCC/CP/1997/5	Adoption of the rules of procedure: note by Mr. Chen Chimutengwende (Zimbabwe), President of the Conference of the Parties at its second session, on his informal consultations on the draft rules of procedure
FCCC/CP/1997/6	Credentials of the representatives of Parties to the third session of the Conference of the Parties to the United Nations Framework Convention on Climate Change: report of the Bureau
FCCC/CP/1997/INF.1	Administrative and financial matters: Programme budget of the Convention for the biennium 1998-1999. Detailed subprogramme activities and resource requirements
FCCC/CP/1997/INF.2	Status of ratification of the United Nations Framework Convention on Climate Change
FCCC/CP/1997/INF.3	Secretariat activities relating to technical and financial support to Parties
FCCC/CP/1997/INF.4	Report on the status of contributions to the core budget for the biennium 1996-1997.
FCCC/CP/1997/INF.5	List of participants

FCCC/CP/1997/MISC.2	Provisional list of participants
FCCC/CP/1997/MISC.3	Review of information and possible decisions under Article 4.2 (f): submission by Turkey
FCCC/CP/1997/CRP.5	Report of the round table on transfer of technology and know-how
FCCC/CP/1997/L.1	High-level segment attended by ministers and other heads of delegation: draft list of items proposed by the Group of 77 and China
FCCC/CP/1997/L.2	Date and venue of the fourth session of the Conference of the Parties: draft decision submitted by the President
FCCC/CP/1997/L.3 and Add.1	Review of information and possible decisions under Article 4.2(f): draft decision proposed by Mr. Luis Herrera Marcano (Venezuela), Vice-President of the Conference
FCCC/CP/1997/L.4	Draft report of the Conference of the Parties on its third session
FCCC/CP/1997/L.5	Methodological issues related to a protocol or another legal instrument: draft decision sumitted by the Commitee of the Whole
FCCC/CP/1997/L.6	Expression of gratitude to the Government and the people of Japan: draft resolution submitted by Bhutan
FCCC/CP/1997/L.7	Adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change: draft decision submitted by the Committee of the Whole
FCCC/CP/1997/L.7/Add.1	Kyoto Protocol to the United Nations Framework Convention on Climate Change
FCCC/CP/1997/L.8	Programme budget for the biennium 1998-1999: draft decision submitted by the Chairman of the SBI
FCCC/CP/1997/L.9	Implementation of Article 4.8 of the Convention: draft decision submitted by the Committee of the Whole
FCCC/SB/1997/1	Progress report on technology and technology transfer
FCCC/SB/1997/3	Development and transfer of technologies: Progress report

FCCC/SB/1997/4	Development and transfer of technologies: Update to progress report
FCCC/SBSTA/1996/20	Report of the Subsidiary Body for Scientific and Technological Advice on the work of its fourth session, Geneva, 16-18 December 1996
FCCC/SBSTA/1997/4	Report of the Subsidiary Body for Scientific and Technological Advice on the work of its fifth session, Bonn, 25-28 February 1997
FCCC/SBSTA/1997/6	Report of the Subsidiary Body for Scientific and Technological Advice on the work of its sixth session, Bonn, 28 July - 5 August 1 1997
FCCC/SBSTA/1997/10	Development and transfer of technologies: Progress report
FCCC/SBSTA/1997/12 and Corr.1-2, and Add.1	Activities implemented jointly under the pilot phase: Synthesis report on activities implemented jointly
FCCC/SBSTA/1997/14	Report of the Subsidiary Body for Scientific and Technological Advice on the work of its seventh session, Bonn, 20-28 October 1997
FCCC/SBSTA/1997/INF.3	Activities implemented jointly under the pilot phase: Contact and activity information
FCCC/SBI/1996/14	Report of the Subsidiary Body for Implementation on the work of its fourth session, Geneva, 10-11 December 1996
FCCC/SBI/1997/6	Report of the Subsidiary Body for Implementation on the work of its fifth session, Bonn, 25 February - 7 March 1997
FCCC/SBI/1997/10	Proposed programme budget of the Convention for the biennium 1998-1999
FCCC/SBI/1997/12	Volume of documentation
FCCC/SBI/1997/15	Amendments to the Convention or its Annexes
FCCC/SBI/1997/16	Report of the Subsidiary Body for Implementation on the work of its sixth session, Bonn, 28 July - 5 August 1997

FCCC/SBI/1997/18	Financial performance of UNFCCC: Contributions and expenditures in 1996-1997, and forecast for the biennium 1996-1997
FCCC/SBI/1997/21	Report of the Subsidiary Body for Implementation on the work of its seventh session, Bonn, 20-29 October 1997
FCCC/AGBM/1996/8	Report of the Ad Hoc Group on the Berlin Mandate on the work of its fourth session, Geneva, 11-16 July 1996
FCCC/AGBM/1996/11	Report of the Ad Hoc Group on the Berlin Mandate on the work of its fifth session, Geneva, 9-12 December 1996
FCCC/AGBM/1997/3 and Add.1 an Corr.1	Report of the Ad Hoc Group on the Berlin Mandate on the work of its sixth session, Bonn, 3-7 March 1997
FCCC/AGBM/1997/5	Report of the Ad Hoc Group on the Berlin Mandate on the work of its seventh session, Bonn, 31 July - 7 August 1997
FCCC/AGBM/1997/8	Report of the Ad Hoc Group on the Berlin Mandate on the work of the first part of its eighth session, Bonn, 22-31 October 1997
FCCC/AGBM/1997/8/Add.1	Report of the Ad Hoc Group on the Berlin Mandate on the work of the second part of its eighth session, Kyoto, 30 November 1997
FCCC/AG13/1996/4	Report of the Ad Hoc Group on Article 13 on the work of its third session, Geneva, 16-18 December 1996
FCCC/AG13/1997/2	Report of the Ad Hoc Group on Article 13 on the work of its fourth session, Bonn, 25-28 February 1997
FCCC/AG13/1997/4	Report of the Ad Hoc Group on Article 13 on the work of its fifth session, Bonn, 28-30 July 1997

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UNITED
NATIONS

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on Climate Change

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REPORT OF THE CONFERENCE OF THE PARTIES ON ITS THIRD SESSION, HELD AT KYOTO FROM 1 TO 11 DECEMBER 1997

Corrigendum

Page 17, section J. Attendance, paragraph 40

Line 2: for 158 read 159

After Niger insert Nigeria

BNJ.98-

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REPORT OF THE CONFERENCE OF THE PARTIES ON ITS THIRD SESSION, HELD AT KYOTO FROM 1 TO 11 DECEMBER 1997

Addendum

PART TWO: ACTION TAKEN BY THE CONFERENCE OF THE PARTIES AT ITS THIRD SESSION

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I. DECISIONS ADOPTED BY THE CONFERENCE OF THE PARTIES

Decision 1/CP.3

Adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change

The Conference of the Parties,

Having reviewed Article 4, paragraph 2(a) and (b), of the United Nations Framework Convention on Climate Change at its first session and having concluded that these subparagraphs are not adequate,

Recalling its decision 1/CP.1 entitled "The Berlin Mandate: Review of the adequacy of Article 4, paragraph 2(a) and (b), of the Convention, including proposals related to a protocol and decisions on follow-up", by which it agreed to begin a process to enable it to take appropriate action for the period beyond 2000 through the adoption of a protocol or another legal instrument at its third session,

Recalling further that one aim of the process was to strengthen the commitments in Article 4, paragraph 2(a) and (b) of the Convention, for developed country/other Parties included in Annex I, both to elaborate policies and measures, and to set quantified limitation and reduction objectives within specified time-frames, such as 2005, 2010 and 2020, for their anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol,

Recalling also that, according to the Berlin Mandate, the process will not introduce any new commitments for Parties not included in Annex I, but reaffirm existing commitments in Article 4, paragraph 1, and continue to advance the implementation of these commitments in order to achieve sustainable development, taking into account Article 4, paragraphs 3, 5 and 7,

Noting the reports of the Ad Hoc Group on the Berlin Mandate on its eight sessions,[1]

Having considered with appreciation the report presented by the Chairman of the Ad Hoc Group on the Berlin Mandate,

Taking note with appreciation of the report of the Chairman of the Committee of the Whole on the outcome of the work of the Committee,

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[1] FCCC/AGBM/1995/2 and Corr.1, and 7 and Corr.1; FCCC/AGBM/1996/5, 8, and 11; FCCC/AGBM/1997/3, 3/Add.1 and Corr.1, 5, 8 and 8/Add.1.

Recognizing the need to prepare for the early entry into force of the Kyoto Protocol to the United Nations Framework Convention on Climate Change,

Aware of the desirability of the timely commencement of work to pave the way for a successful outcome of the fourth session of the Conference of the Parties, to be held in Buenos Aires, Argentina,

1. *Decides to adopt* the Kyoto Protocol to the United Nations Framework Convention on Climate Change, annexed hereto;

2. *Requests* the Secretary-General of the United Nations to be the Depositary of this Protocol and to open it for signature in New York from 16 March 1998 until 15 March 1999;

3. *Invites* all Parties to the United Nations Framework Convention on Climate Change to sign the Protocol on 16 March 1998 or at the earliest opportunity thereafter, and to deposit instruments of ratification, acceptance or approval, or instruments of accession where appropriate, as soon as possible;

4. *Further invites* States that are not parties to the Convention to ratify or accede to it, as appropriate, without delay, so that they may become Parties to the Protocol;

5. *Requests* the Chairman of the Subsidiary Body for Scientific and Technological Advice and the Chairman of the Subsidiary Body for Implementation, taking into account the approved programme budget for the biennium 1998-1999 and the related programme of work of the secretariat,[2] to give guidance to the secretariat on the preparatory work needed for consideration by the Conference of the Parties, at its fourth session, of the following matters, and to allocate work thereon to the respective subsidiary bodies as appropriate:

(a) Determination of modalities, rules and guidelines as to how, and which, additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties to the Protocol included in Annex I to the Convention, as provided for under Article 3, paragraph 4, of the Protocol;

(b) Definition of relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability of emissions trading, pursuant to Article 17 of the Protocol;

(c) Elaboration of guidelines for any Party to the Protocol included in Annex I to the Convention to transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy, as provided for under Article 6 of the Protocol;

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[2] FCCC/CP/1997/INF.1.

(d) Consideration of and, as appropriate, action on suitable methodologies to address the situation of Parties listed in Annex B to the Protocol for which single projects would have a significant proportional impact on emissions in the commitment period;

(e) Analysis of the implications of Article 12, paragraph 10, of the Protocol;

6. *Invites* the Chairman of the Subsidiary Body for Scientific and Technological Advice and the Chairman of the Subsidiary Body for Implementation to make a joint proposal to those bodies, at their eighth sessions, on the allocation to them of preparatory work to enable the Conference of the Parties serving as the meeting of the Parties to the Protocol, at its first session after the entry into force of the Protocol, to accomplish the tasks assigned to it by the Protocol.

12th plenary meeting
11 December 1997

Annex

KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The Parties to this Protocol,

Being Parties to the United Nations Framework Convention on Climate Change, hereinafter referred to as "the Convention",

In pursuit of the ultimate objective of the Convention as stated in its Article 2,

Recalling the provisions of the Convention,

Being guided by Article 3 of the Convention,

Pursuant to the Berlin Mandate adopted by decision 1/CP.1 of the Conference of the Parties to the Convention at its first session,

Have agreed as follows:

Article 1

For the purposes of this Protocol, the definitions contained in Article 1 of the Convention shall apply. In addition:

1. "Conference of the Parties" means the Conference of the Parties to the Convention.

2. "Convention" means the United Nations Framework Convention on Climate Change, adopted in New York on 9 May 1992.

3. "Intergovernmental Panel on Climate Change" means the Intergovernmental Panel on Climate Change established in 1988 jointly by the World Meteorological Organization and the United Nations Environment Programme.

4. "Montreal Protocol" means the Montreal Protocol on Substances that Deplete the Ozone Layer, adopted in Montreal on 16 September 1987 and as subsequently adjusted and amended.

5. "Parties present and voting" means Parties present and casting an affirmative or negative vote.

6. "Party" means, unless the context otherwise indicates, a Party to this Protocol.

7. "Party included in Annex I" means a Party included in Annex I to the Convention, as may be amended, or a Party which has made a notification under Article 4, paragraph 2(g), of the Convention.

Article 2

1. Each Party included in Annex I, in achieving its quantified emission limitation and reduction commitments under Article 3, in order to promote sustainable development, shall:

(a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:

- (i) Enhancement of energy efficiency in relevant sectors of the national economy;
- (ii) Protection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol, taking into account its commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and reforestation;
- (iii) Promotion of sustainable forms of agriculture in light of climate change considerations;
- (iv) Research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies;
- (v) Progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and application of market instruments;
- (vi) Encouragement of appropriate reforms in relevant sectors aimed at promoting policies and measures which limit or reduce emissions of greenhouse gases not controlled by the Montreal Protocol;
- (vii) Measures to limit and/or reduce emissions of greenhouse gases not controlled by the Montreal Protocol in the transport sector;

(viii) Limitation and/or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy;

(b) Cooperate with other such Parties to enhance the individual and combined effectiveness of their policies and measures adopted under this Article, pursuant to Article 4, paragraph 2(e)(i), of the Convention. To this end, these Parties shall take steps to share their experience and exchange information on such policies and measures, including developing ways of improving their comparability, transparency and effectiveness. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, consider ways to facilitate such cooperation, taking into account all relevant information.

2. The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively.

3. The Parties included in Annex I shall strive to implement policies and measures under this Article in such a way as to minimize adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties and in particular those identified in Article 4, paragraphs 8 and 9, of the Convention, taking into account Article 3 of the Convention. The Conference of the Parties serving as the meeting of the Parties to this Protocol may take further action, as appropriate, to promote the implementation of the provisions of this paragraph.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol, if it decides that it would be beneficial to coordinate any of the policies and measures in paragraph 1(a) above, taking into account different national circumstances and potential effects, shall consider ways and means to elaborate the coordination of such policies and measures.

Article 3

1. The Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012.

2. Each Party included in Annex I shall, by 2005, have made demonstrable progress in achieving its commitments under this Protocol.

3. The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex I. The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8.

4. Prior to the first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol, each Party included in Annex I shall provide, for consideration by the Subsidiary Body for Scientific and Technological Advice, data to establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes in carbon stocks in subsequent years. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, decide upon modalities, rules and guidelines as to how, and which, additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, the methodological work of the Intergovernmental Panel on Climate Change, the advice provided by the Subsidiary Body for Scientific and Technological Advice in accordance with Article 5 and the decisions of the Conference of the Parties. Such a decision shall apply in the second and subsequent commitment periods. A Party may choose to apply such a decision on these additional human-induced activities for its first commitment period, provided that these activities have taken place since 1990.

5. The Parties included in Annex I undergoing the process of transition to a market economy whose base year or period was established pursuant to decision 9/CP.2 of the Conference of the Parties at its second session shall use that base year or period for the implementation of their commitments under this Article. Any other Party included in Annex I undergoing the process of transition to a market economy which has not yet submitted its first national communication under Article 12 of the Convention may also notify the Conference of the Parties serving as the meeting of the Parties to this Protocol that it intends to use an historical base year or period other than 1990 for the implementation of its commitments under this Article. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall decide on the acceptance of such notification.

6. Taking into account Article 4, paragraph 6, of the Convention, in the implementation of their commitments under this Protocol other than those under this Article, a certain degree of flexibility shall be allowed by the Conference of the Parties serving as the meeting of the Parties to this Protocol to the Parties included in Annex I undergoing the process of transition to a market economy.

7. In the first quantified emission limitation and reduction commitment period, from 2008 to 2012, the assigned amount for each Party included in Annex I shall be equal to the percentage inscribed for it in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A in 1990, or the base year or period determined in accordance with paragraph 5 above, multiplied by five. Those Parties included in Annex I for whom land-use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions by sources minus removals by sinks in 1990 from land-use change for the purposes of calculating their assigned amount.

8. Any Party included in Annex I may use 1995 as its base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, for the purposes of the calculation referred to in paragraph 7 above.

9. Commitments for subsequent periods for Parties included in Annex I shall be established in amendments to Annex B to this Protocol, which shall be adopted in accordance with the provisions of Article 21, paragraph 7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall initiate the consideration of such commitments at least seven years before the end of the first commitment period referred to in paragraph 1 above.

10. Any emission reduction units, or any part of an assigned amount, which a Party acquires from another Party in accordance with the provisions of Article 6 or of Article 17 shall be added to the assigned amount for the acquiring Party.

11. Any emission reduction units, or any part of an assigned amount, which a Party transfers to another Party in accordance with the provisions of Article 6 or of Article 17 shall be subtracted from the assigned amount for the transferring Party.

12. Any certified emission reductions which a Party acquires from another Party in accordance with the provisions of Article 12 shall be added to the assigned amount for the acquiring Party.

13. If the emissions of a Party included in Annex I in a commitment period are less than its assigned amount under this Article, this difference shall, on request of that Party, be added to the assigned amount for that Party for subsequent commitment periods.

14. Each Party included in Annex I shall strive to implement the commitments mentioned in paragraph 1 above in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties, particularly those identified in Article 4, paragraphs 8 and 9, of the Convention. In line with relevant decisions of the Conference of the Parties on the implementation of those paragraphs, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, consider what actions are necessary to minimize the adverse effects of climate change and/or the impacts of response measures on Parties referred

to in those paragraphs. Among the issues to be considered shall be the establishment of funding, insurance and transfer of technology.

Article 4

1. Any Parties included in Annex I that have reached an agreement to fulfil their commitments under Article 3 jointly, shall be deemed to have met those commitments provided that their total combined aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of Article 3. The respective emission level allocated to each of the Parties to the agreement shall be set out in that agreement.

2. The Parties to any such agreement shall notify the secretariat of the terms of the agreement on the date of deposit of their instruments of ratification, acceptance or approval of this Protocol, or accession thereto. The secretariat shall in turn inform the Parties and signatories to the Convention of the terms of the agreement.

3. Any such agreement shall remain in operation for the duration of the commitment period specified in Article 3, paragraph 7.

4. If Parties acting jointly do so in the framework of, and together with, a regional economic integration organization, any alteration in the composition of the organization after adoption of this Protocol shall not affect existing commitments under this Protocol. Any alteration in the composition of the organization shall only apply for the purposes of those commitments under Article 3 that are adopted subsequent to that alteration.

5. In the event of failure by the Parties to such an agreement to achieve their total combined level of emission reductions, each Party to that agreement shall be responsible for its own level of emissions set out in the agreement.

6. If Parties acting jointly do so in the framework of, and together with, a regional economic integration organization which is itself a Party to this Protocol, each member State of that regional economic integration organization individually, and together with the regional economic integration organization acting in accordance with Article 24, shall, in the event of failure to achieve the total combined level of emission reductions, be responsible for its level of emissions as notified in accordance with this Article.

Article 5

1. Each Party included in Annex I shall have in place, no later than one year prior to the start of the first commitment period, a national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. Guidelines for such national systems, which shall incorporate the

methodologies specified in paragraph 2 below, shall be decided upon by the Conference of the Parties serving as the meeting of the Parties to this Protocol at its first session.

2. Methodologies for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol shall be those accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties at its third session. Where such methodologies are not used, appropriate adjustments shall be applied according to methodologies agreed upon by the Conference of the Parties serving as the meeting of the Parties to this Protocol at its first session. Based on the work of, *inter alia*, the Intergovernmental Panel on Climate Change and advice provided by the Subsidiary Body for Scientific and Technological Advice, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall regularly review and, as appropriate, revise such methodologies and adjustments, taking fully into account any relevant decisions by the Conference of the Parties. Any revision to methodologies or adjustments shall be used only for the purposes of ascertaining compliance with commitments under Article 3 in respect of any commitment period adopted subsequent to that revision.

3. The global warming potentials used to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of greenhouse gases listed in Annex A shall be those accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties at its third session. Based on the work of, *inter alia*, the Intergovernmental Panel on Climate Change and advice provided by the Subsidiary Body for Scientific and Technological Advice, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall regularly review and, as appropriate, revise the global warming potential of each such greenhouse gas, taking fully into account any relevant decisions by the Conference of the Parties. Any revision to a global warming potential shall apply only to commitments under Article 3 in respect of any commitment period adopted subsequent to that revision.

Article 6

1. For the purpose of meeting its commitments under Article 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy, provided that:

(a) Any such project has the approval of the Parties involved;

(b) Any such project provides a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to any that would otherwise occur;

(c) It does not acquire any emission reduction units if it is not in compliance with its obligations under Articles 5 and 7; and

(d) The acquisition of emission reduction units shall be supplemental to domestic actions for the purposes of meeting commitments under Article 3.

2. The Conference of the Parties serving as the meeting of the Parties to this Protocol may, at its first session or as soon as practicable thereafter, further elaborate guidelines for the implementation of this Article, including for verification and reporting.

3. A Party included in Annex I may authorize legal entities to participate, under its responsibility, in actions leading to the generation, transfer or acquisition under this Article of emission reduction units.

4. If a question of implementation by a Party included in Annex I of the requirements referred to in this Article is identified in accordance with the relevant provisions of Article 8, transfers and acquisitions of emission reduction units may continue to be made after the question has been identified, provided that any such units may not be used by a Party to meet its commitments under Article 3 until any issue of compliance is resolved.

Article 7

1. Each Party included in Annex I shall incorporate in its annual inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol, submitted in accordance with the relevant decisions of the Conference of the Parties, the necessary supplementary information for the purposes of ensuring compliance with Article 3, to be determined in accordance with paragraph 4 below.

2. Each Party included in Annex I shall incorporate in its national communication, submitted under Article 12 of the Convention, the supplementary information necessary to demonstrate compliance with its commitments under this Protocol, to be determined in accordance with paragraph 4 below.

3. Each Party included in Annex I shall submit the information required under paragraph 1 above annually, beginning with the first inventory due under the Convention for the first year of the commitment period after this Protocol has entered into force for that Party. Each such Party shall submit the information required under paragraph 2 above as part of the first national communication due under the Convention after this Protocol has entered into force for it and after the adoption of guidelines as provided for in paragraph 4 below. The frequency of subsequent submission of information required under this Article shall be determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol, taking into account any timetable for the submission of national communications decided upon by the Conference of the Parties.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall adopt at its first session, and review periodically thereafter, guidelines for the preparation of the information required under this Article, taking into account guidelines for the preparation of

national communications by Parties included in Annex I adopted by the Conference of the Parties. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall also, prior to the first commitment period, decide upon modalities for the accounting of assigned amounts.

Article 8

1. The information submitted under Article 7 by each Party included in Annex I shall be reviewed by expert review teams pursuant to the relevant decisions of the Conference of the Parties and in accordance with guidelines adopted for this purpose by the Conference of the Parties serving as the meeting of the Parties to this Protocol under paragraph 4 below. The information submitted under Article 7, paragraph 1, by each Party included in Annex I shall be reviewed as part of the annual compilation and accounting of emissions inventories and assigned amounts. Additionally, the information submitted under Article 7, paragraph 2, by each Party included in Annex I shall be reviewed as part of the review of communications.

2. Expert review teams shall be coordinated by the secretariat and shall be composed of experts selected from those nominated by Parties to the Convention and, as appropriate, by intergovernmental organizations, in accordance with guidance provided for this purpose by the Conference of the Parties.

3. The review process shall provide a thorough and comprehensive technical assessment of all aspects of the implementation by a Party of this Protocol. The expert review teams shall prepare a report to the Conference of the Parties serving as the meeting of the Parties to this Protocol, assessing the implementation of the commitments of the Party and identifying any potential problems in, and factors influencing, the fulfilment of commitments. Such reports shall be circulated by the secretariat to all Parties to the Convention. The secretariat shall list those questions of implementation indicated in such reports for further consideration by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall adopt at its first session, and review periodically thereafter, guidelines for the review of implementation of this Protocol by expert review teams taking into account the relevant decisions of the Conference of the Parties.

5. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, with the assistance of the Subsidiary Body for Implementation and, as appropriate, the Subsidiary Body for Scientific and Technological Advice, consider:

(a) The information submitted by Parties under Article 7 and the reports of the expert reviews thereon conducted under this Article; and

(b) Those questions of implementation listed by the secretariat under paragraph 3 above, as well as any questions raised by Parties.

6. Pursuant to its consideration of the information referred to in paragraph 5 above, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall take decisions on any matter required for the implementation of this Protocol.

Article 9

1. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall periodically review this Protocol in the light of the best available scientific information and assessments on climate change and its impacts, as well as relevant technical, social and economic information. Such reviews shall be coordinated with pertinent reviews under the Convention, in particular those required by Article 4, paragraph 2(d), and Article 7, paragraph 2(a), of the Convention. Based on these reviews, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall take appropriate action.

2. The first review shall take place at the second session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. Further reviews shall take place at regular intervals and in a timely manner.

Article 10

All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, without introducing any new commitments for Parties not included in Annex I, but reaffirming existing commitments under Article 4, paragraph 1, of the Convention, and continuing to advance the implementation of these commitments in order to achieve sustainable development, taking into account Article 4, paragraphs 3, 5 and 7, of the Convention, shall:

(a) Formulate, where relevant and to the extent possible, cost-effective national and, where appropriate, regional programmes to improve the quality of local emission factors, activity data and/or models which reflect the socio-economic conditions of each Party for the preparation and periodic updating of national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties, and consistent with the guidelines for the preparation of national communications adopted by the Conference of the Parties;

(b) Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change and measures to facilitate adequate adaptation to climate change:

(i) Such programmes would, *inter alia*, concern the energy, transport and industry sectors as well as agriculture, forestry and waste management. Furthermore, adaptation technologies and methods for improving spatial planning would improve adaptation to climate change; and

(ii) Parties included in Annex I shall submit information on action under this Protocol, including national programmes, in accordance with Article 7; and other Parties shall seek to include in their national communications, as appropriate, information on programmes which contain measures that the Party believes contribute to addressing climate change and its adverse impacts, including the abatement of increases in greenhouse gas emissions, and enhancement of and removals by sinks, capacity building and adaptation measures;

(c) Cooperate in the promotion of effective modalities for the development, application and diffusion of, and take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries, including the formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain and the creation of an enabling environment for the private sector, to promote and enhance the transfer of, and access to, environmentally sound technologies;

(d) Cooperate in scientific and technical research and promote the maintenance and the development of systematic observation systems and development of data archives to reduce uncertainties related to the climate system, the adverse impacts of climate change and the economic and social consequences of various response strategies, and promote the development and strengthening of endogenous capacities and capabilities to participate in international and intergovernmental efforts, programmes and networks on research and systematic observation, taking into account Article 5 of the Convention;

(e) Cooperate in and promote at the international level, and, where appropriate, using existing bodies, the development and implementation of education and training programmes, including the strengthening of national capacity building, in particular human and institutional capacities and the exchange or secondment of personnel to train experts in this field, in particular for developing countries, and facilitate at the national level public awareness of, and public access to information on, climate change. Suitable modalities should be developed to implement these activities through the relevant bodies of the Convention, taking into account Article 6 of the Convention;

(f) Include in their national communications information on programmes and activities undertaken pursuant to this Article in accordance with relevant decisions of the Conference of the Parties; and

(g) Give full consideration, in implementing the commitments under this Article, to Article 4, paragraph 8, of the Convention.

Article 11

1. In the implementation of Article 10, Parties shall take into account the provisions of Article 4, paragraphs 4, 5, 7, 8 and 9, of the Convention.

2. In the context of the implementation of Article 4, paragraph 1, of the Convention, in accordance with the provisions of Article 4, paragraph 3, and Article 11 of the Convention, and through the entity or entities entrusted with the operation of the financial mechanism of the Convention, the developed country Parties and other developed Parties included in Annex II to the Convention shall:

(a) Provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in advancing the implementation of existing commitments under Article 4, paragraph 1(a), of the Convention that are covered in Article 10, subparagraph (a); and

(b) Also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of advancing the implementation of existing commitments under Article 4, paragraph 1, of the Convention that are covered by Article 10 and that are agreed between a developing country Party and the international entity or entities referred to in Article 11 of the Convention, in accordance with that Article.

The implementation of these existing commitments shall take into account the need for adequacy and predictability in the flow of funds and the importance of appropriate burden sharing among developed country Parties. The guidance to the entity or entities entrusted with the operation of the financial mechanism of the Convention in relevant decisions of the Conference of the Parties, including those agreed before the adoption of this Protocol, shall apply *mutatis mutandis* to the provisions of this paragraph.

3. The developed country Parties and other developed Parties in Annex II to the Convention may also provide, and developing country Parties avail themselves of, financial resources for the implementation of Article 10, through bilateral, regional and other multilateral channels.

Article 12

1. A clean development mechanism is hereby defined.

2. The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.

3. Under the clean development mechanism:

(a) Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and

(b) Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The clean development mechanism shall be subject to the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Protocol and be supervised by an executive board of the clean development mechanism.

5. Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the Conference of the Parties serving as the meeting of the Parties to this Protocol, on the basis of:

(a) Voluntary participation approved by each Party involved;

(b) Real, measurable, and long-term benefits related to the mitigation of climate change; and

(c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

6. The clean development mechanism shall assist in arranging funding of certified project activities as necessary.

7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, elaborate modalities and procedures with the objective of ensuring transparency, efficiency and accountability through independent auditing and verification of project activities.

8. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall ensure that a share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

9. Participation under the clean development mechanism, including in activities mentioned in paragraph 3(a) above and in the acquisition of certified emission reductions, may involve private and/or public entities, and is to be subject to whatever guidance may be provided by the executive board of the clean development mechanism.

10. Certified emission reductions obtained during the period from the year 2000 up to the beginning of the first commitment period can be used to assist in achieving compliance in the first commitment period.

Article 13

1. The Conference of the Parties, the supreme body of the Convention, shall serve as the meeting of the Parties to this Protocol.

2. Parties to the Convention that are not Parties to this Protocol may participate as observers in the proceedings of any session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. When the Conference of the Parties serves as the meeting of the Parties to this Protocol, decisions under this Protocol shall be taken only by those that are Parties to this Protocol.

3. When the Conference of the Parties serves as the meeting of the Parties to this Protocol, any member of the Bureau of the Conference of the Parties representing a Party to the Convention but, at that time, not a Party to this Protocol, shall be replaced by an additional member to be elected by and from amongst the Parties to this Protocol.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall keep under regular review the implementation of this Protocol and shall make, within its mandate, the decisions necessary to promote its effective implementation. It shall perform the functions assigned to it by this Protocol and shall:

(a) Assess, on the basis of all information made available to it in accordance with the provisions of this Protocol, the implementation of this Protocol by the Parties, the overall effects of the measures taken pursuant to this Protocol, in particular environmental, economic and social effects as well as their cumulative impacts and the extent to which progress towards the objective of the Convention is being achieved;

(b) Periodically examine the obligations of the Parties under this Protocol, giving due consideration to any reviews required by Article 4, paragraph 2(d), and Article 7, paragraph 2, of the Convention, in the light of the objective of the Convention, the experience gained in its implementation and the evolution of scientific and technological knowledge, and in this respect consider and adopt regular reports on the implementation of this Protocol;

(c) Promote and facilitate the exchange of information on measures adopted by the Parties to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under this Protocol;

(d) Facilitate, at the request of two or more Parties, the coordination of measures adopted by them to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under this Protocol;

(e) Promote and guide, in accordance with the objective of the Convention and the provisions of this Protocol, and taking fully into account the relevant decisions by the Conference of the Parties, the development and periodic refinement of comparable methodologies for the effective implementation of this Protocol, to be agreed on by the Conference of the Parties serving as the meeting of the Parties to this Protocol;

(f) Make recommendations on any matters necessary for the implementation of this Protocol;

(g) Seek to mobilize additional financial resources in accordance with Article 11, paragraph 2;

(h) Establish such subsidiary bodies as are deemed necessary for the implementation of this Protocol;

(i) Seek and utilize, where appropriate, the services and cooperation of, and information provided by, competent international organizations and intergovernmental and non-governmental bodies; and

(j) Exercise such other functions as may be required for the implementation of this Protocol, and consider any assignment resulting from a decision by the Conference of the Parties.

5. The rules of procedure of the Conference of the Parties and financial procedures applied under the Convention shall be applied *mutatis mutandis* under this Protocol, except as may be otherwise decided by consensus by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

6. The first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be convened by the secretariat in conjunction with the first session of the Conference of the Parties that is scheduled after the date of the entry into force of this Protocol. Subsequent ordinary sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be held every year and in conjunction with ordinary sessions of the Conference of the Parties, unless otherwise decided by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

7. Extraordinary sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be held at such other times as may be deemed necessary by the Conference of the Parties serving as the meeting of the Parties to this Protocol, or at the written request of any Party, provided that, within six months of the request being communicated to the Parties by the secretariat, it is supported by at least one third of the Parties.

8. The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State member thereof or observers thereto not party to the Convention, may be represented at sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol as observers. Any body or agency, whether national or international, governmental or non-governmental, which is qualified in matters covered by this Protocol and which has informed the secretariat of its wish to be represented at a session of the Conference of the Parties serving as the meeting of the Parties to this Protocol as an observer, may be so admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure, as referred to in paragraph 5 above.

Article 14

1. The secretariat established by Article 8 of the Convention shall serve as the secretariat of this Protocol.

2. Article 8, paragraph 2, of the Convention on the functions of the secretariat, and Article 8, paragraph 3, of the Convention on arrangements made for the functioning of the secretariat, shall apply *mutatis mutandis* to this Protocol. The secretariat shall, in addition, exercise the functions assigned to it under this Protocol.

Article 15

1. The Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation established by Articles 9 and 10 of the Convention shall serve as, respectively, the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of this Protocol. The provisions relating to the functioning of these two bodies under the Convention shall apply *mutatis mutandis* to this Protocol. Sessions of the meetings of the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of this Protocol shall be held in conjunction with the meetings of, respectively, the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of the Convention.

2. Parties to the Convention that are not Parties to this Protocol may participate as observers in the proceedings of any session of the subsidiary bodies. When the subsidiary bodies serve as the subsidiary bodies of this Protocol, decisions under this Protocol shall be taken only by those that are Parties to this Protocol.

3. When the subsidiary bodies established by Articles 9 and 10 of the Convention exercise their functions with regard to matters concerning this Protocol, any member of the Bureaux of those subsidiary bodies representing a Party to the Convention but, at that time, not a party to this Protocol, shall be replaced by an additional member to be elected by and from amongst the Parties to this Protocol.

Article 16

The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, as soon as practicable, consider the application to this Protocol of, and modify as appropriate, the multilateral consultative process referred to in Article 13 of the Convention, in the light of any relevant decisions that may be taken by the Conference of the Parties. Any multilateral consultative process that may be applied to this Protocol shall operate without prejudice to the procedures and mechanisms established in accordance with Article 18.

Article 17

The Conference of the Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading. The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article.

Article 18

The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, approve appropriate and effective procedures and mechanisms to determine and to address cases of non-compliance with the provisions of this Protocol, including through the development of an indicative list of consequences, taking into account the cause, type, degree and frequency of non-compliance. Any procedures and mechanisms under this Article entailing binding consequences shall be adopted by means of an amendment to this Protocol.

Article 19

The provisions of Article 14 of the Convention on settlement of disputes shall apply *mutatis mutandis* to this Protocol.

Article 20

1. Any Party may propose amendments to this Protocol.

2. Amendments to this Protocol shall be adopted at an ordinary session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. The text of any proposed amendment to this Protocol shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate the text of any proposed amendments to the Parties and signatories to the Convention and, for information, to the Depositary.

3. The Parties shall make every effort to reach agreement on any proposed amendment to this Protocol by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted amendment shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.

4. Instruments of acceptance in respect of an amendment shall be deposited with the Depositary. An amendment adopted in accordance with paragraph 3 above shall enter into force for those Parties having accepted it on the ninetieth day after the date of receipt by the Depositary of an instrument of acceptance by at least three fourths of the Parties to this Protocol.

5. The amendment shall enter into force for any other Party on the ninetieth day after the date on which that Party deposits with the Depositary its instrument of acceptance of the said amendment.

Article 21

1. Annexes to this Protocol shall form an integral part thereof and, unless otherwise expressly provided, a reference to this Protocol constitutes at the same time a reference to any annexes thereto. Any annexes adopted after the entry into force of this Protocol shall be restricted to lists, forms and any other material of a descriptive nature that is of a scientific, technical, procedural or administrative character.

2. Any Party may make proposals for an annex to this Protocol and may propose amendments to annexes to this Protocol.

3. Annexes to this Protocol and amendments to annexes to this Protocol shall be adopted at an ordinary session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. The text of any proposed annex or amendment to an annex shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate the text of any proposed annex or amendment to an annex to the Parties and signatories to the Convention and, for information, to the Depositary.

4. The Parties shall make every effort to reach agreement on any proposed annex or amendment to an annex by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the annex or amendment to an annex shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted annex or amendment to an annex shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.

5. An annex, or amendment to an annex other than Annex A or B, that has been adopted in accordance with paragraphs 3 and 4 above shall enter into force for all Parties to this Protocol six months after the date of the communication by the Depositary to such Parties of the adoption of

the annex or adoption of the amendment to the annex, except for those Parties that have notified the Depositary, in writing, within that period of their non-acceptance of the annex or amendment to the annex. The annex or amendment to an annex shall enter into force for Parties which withdraw their notification of non-acceptance on the ninetieth day after the date on which withdrawal of such notification has been received by the Depositary.

6. If the adoption of an annex or an amendment to an annex involves an amendment to this Protocol, that annex or amendment to an annex shall not enter into force until such time as the amendment to this Protocol enters into force.

7. Amendments to Annexes A and B to this Protocol shall be adopted and enter into force in accordance with the procedure set out in Article 20, provided that any amendment to Annex B shall be adopted only with the written consent of the Party concerned.

Article 22

1. Each Party shall have one vote, except as provided for in paragraph 2 below.

2. Regional economic integration organizations, in matters within their competence, shall exercise their right to vote with a number of votes equal to the number of their member States that are Parties to this Protocol. Such an organization shall not exercise its right to vote if any of its member States exercises its right, and vice versa.

Article 23

The Secretary-General of the United Nations shall be the Depositary of this Protocol.

Article 24

1. This Protocol shall be open for signature and subject to ratification, acceptance or approval by States and regional economic integration organizations which are Parties to the Convention. It shall be open for signature at United Nations Headquarters in New York from 16 March 1998 to 15 March 1999. This Protocol shall be open for accession from the day after the date on which it is closed for signature. Instruments of ratification, acceptance, approval or accession shall be deposited with the Depositary.

2. Any regional economic integration organization which becomes a Party to this Protocol without any of its member States being a Party shall be bound by all the obligations under this Protocol. In the case of such organizations, one or more of whose member States is a Party to this Protocol, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under this Protocol. In such cases, the organization and the member States shall not be entitled to exercise rights under this Protocol concurrently.

3. In their instruments of ratification, acceptance, approval or accession, regional economic integration organizations shall declare the extent of their competence with respect to the matters governed by this Protocol. These organizations shall also inform the Depositary, who shall in turn inform the Parties, of any substantial modification in the extent of their competence.

Article 25

1. This Protocol shall enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 per cent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession.

2. For the purposes of this Article, "the total carbon dioxide emissions for 1990 of the Parties included in Annex I" means the amount communicated on or before the date of adoption of this Protocol by the Parties included in Annex I in their first national communications submitted in accordance with Article 12 of the Convention.

3. For each State or regional economic integration organization that ratifies, accepts or approves this Protocol or accedes thereto after the conditions set out in paragraph 1 above for entry into force have been fulfilled, this Protocol shall enter into force on the ninetieth day following the date of deposit of its instrument of ratification, acceptance, approval or accession.

4. For the purposes of this Article, any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by States members of the organization.

Article 26

No reservations may be made to this Protocol.

Article 27

1. At any time after three years from the date on which this Protocol has entered into force for a Party, that Party may withdraw from this Protocol by giving written notification to the Depositary.

2. Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depositary of the notification of withdrawal, or on such later date as may be specified in the notification of withdrawal.

3. Any Party that withdraws from the Convention shall be considered as also having withdrawn from this Protocol.

Article 28

The original of this Protocol, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

DONE at Kyoto this eleventh day of December one thousand nine hundred and ninety-seven.

IN WITNESS WHEREOF the undersigned, being duly authorized to that effect, have affixed their signatures to this Protocol on the dates indicated.

Annex A

Greenhouse gases

Carbon dioxide (CO_2)
Methane (CH_4)
Nitrous oxide (N_2O)
Hydrofluorocarbons (HFCs)
Perfluorocarbons (PFCs)
Sulphur hexafluoride (SF_6)

Sectors/source categories

- Energy
    - Fuel combustion
        - Energy industries
        - Manufacturing industries and construction
        - Transport
        - Other sectors
        - Other
    - Fugitive emissions from fuels
        - Solid fuels
        - Oil and natural gas
        - Other

- Industrial processes
    - Mineral products
    - Chemical industry
    - Metal production
    - Other production
    - Production of halocarbons and sulphur hexafluoride
    - Consumption of halocarbons and sulphur hexafluoride
    - Other

- Solvent and other product use

- Agriculture
    - Enteric fermentation
    - Manure management
    - Rice cultivation
    - Agricultural soils
    - Prescribed burning of savannas
    - Field burning of agricultural residues
    - Other

Waste
- Solid waste disposal on land
- Wastewater handling
- Waste incineration
- Other

Annex B

Party	Quantified emission limitation or reduction commitment (percentage of base year or period)
Australia	108
Austria	92
Belgium	92
Bulgaria*	92
Canada	94
Croatia*	95
Czech Republic*	92
Denmark	92
Estonia*	92
European Community	92
Finland	92
France	92
Germany	92
Greece	92
Hungary*	94
Iceland	110
Ireland	92
Italy	92
Japan	94
Latvia*	92
Liechtenstein	92
Lithuania*	92
Luxembourg	92
Monaco	92
Netherlands	92
New Zealand	100
Norway	101
Poland*	94
Portugal	92
Romania*	92
Russian Federation*	100
Slovakia*	92
Slovenia*	92
Spain	92
Sweden	92
Switzerland	92
Ukraine*	100
United Kingdom of Great Britain and Northern Ireland	92
United States of America	93

* Countries that are undergoing the process of transition to a market economy.

Decision 2/CP.3

Methodological issues related to the Kyoto protocol

The Conference of the Parties,

Recalling its decisions 4/CP.1 and 9/CP.2,

Endorsing the relevant conclusions of the Subsidiary Body for Scientific and Technological Advice at its fourth session,[1]

1. *Reaffirms* that Parties should use the Revised 1996 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change to estimate and report on anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol;

2. *Affirms* that the actual emissions of hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride should be estimated, where data are available, and used for the reporting of emissions. Parties should make every effort to develop the necessary sources of data;

3. *Reaffirms* that global warming potentials used by Parties should be those provided by the Intergovernmental Panel on Climate Change in its Second Assessment Report ("1995 IPCC GWP values") based on the effects of the greenhouse gases over a 100-year time horizon, taking into account the inherent and complicated uncertainties involved in global warming potential estimates. In addition, for information purposes only, Parties may also use another time horizon, as provided in the Second Assessment Report;

4. *Recalls* that, under the Revised 1996 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change, emissions based upon fuel sold to ships or aircraft engaged in international transport should not be included in national totals, but reported separately; and *urges* the Subsidiary Body for Scientific and Technological Advice to further elaborate on the inclusion of these emissions in the overall greenhouse gas inventories of Parties;

5. *Decides* that emissions resulting from multilateral operations pursuant to the Charter of the United Nations shall not be included in national totals, but reported separately; other emissions related to operations shall be included in the national emissions totals of one or more Parties involved.

12th plenary meeting
11 December 1997

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[1] FCCC/SBSTA/1996/20, paras. 30 and 54.

Decision 3/CP.3

Implementation of Article 4, paragraphs 8 and 9, of the Convention

The Conference of the Parties,

Noting the provisions of Article 4, paragraphs 8 and 9, of the United Nations Framework Convention on Climate Change,

Noting further the provisions of Article 3 of the Convention and of the "Berlin Mandate" in its paragraph 1(b),[1]

1. *Requests* the Subsidiary Body for Implementation, at its eighth session, to undertake a process to identify and determine actions necessary to meet the specific needs of developing country Parties, specified under Article 4, paragraphs 8 and 9, of the Convention, arising from adverse effects of climate change and/or the impact of the implementation of response measures. Issues to be considered shall include actions related to funding, insurance and transfer of technology;

2. *Further requests* the Subsidiary Body for Implementation to report to the Conference of the Parties, at its fourth session, on the outcome of this process;

3. *Invites* the Conference of the Parties, at its fourth session, to take a decision on actions based on the conclusions and recommendations of this process.

12th plenary meeting
11 December 1997

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[1] Decision 1/CP.1.

Decision 4/CP.3

Article 4.2(f) of the Convention

The Conference of the Parties,

Recalling Article 4.2 (f) of the United Nations Framework Convention on Climate Change,

Having reviewed available information regarding amendments to the lists in Annexes I and II to the Convention,

Noting that the Parties concerned have granted their approval to be included in the list in Annex I to the Convention,

Bearing in mind the procedure in Article 4.2 (f) of the Convention,

1. *Decides* to amend the list in Annex I to the Convention by:

(a) Deleting the name of Czechoslovakia;

(b) Including the names of Croatia[a], the Czech Republic[a], Liechtenstein, Monaco, Slovakia[a] and Slovenia[a];

2. *Notes* that the entry into force of these amendments to the list included in Annex I to the Convention shall be subject to the same procedure as that for the entry into force of annexes to the Convention in accordance with Article 16.3 of the Convention.

12th plenary meeting
11 December 1997

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[a] Countries that are undergoing transition to a market economy.

Decision 5/CP.3

Date and venue of the fourth session of the Conference of the Parties

The Conference of the Parties,

Recalling Article 7.4 of the United Nations Framework Convention on Climate Change,

Recalling General Assembly resolution 40/243 of 18 December 1985,

Having received an offer from the Government of Argentina to host the fourth session of the Conference of the Parties in Buenos Aires and to cover the related costs involved,

1. *Accepts with gratitude* the generous offer of the Government of Argentina to host the fourth session of the Conference of the Parties;

2. *Decides* that the fourth session of the Conference of the Parties shall be held in Buenos Aires, Argentina, from 2 to 13 November 1998;

3. *Requests* the Executive Secretary to conclude a host country agreement with the Government of Argentina on arrangements for the fourth session of the Conference of the Parties.

5th plenary meeting
5 December 1997

Decision 6/CP.3

Communications from Parties included in Annex I to the Convention

The Conference of the Parties,

Recalling the relevant provisions of the United Nations Framework Convention on Climate Change, its decision 2/CP.1 on review of first communications from the Parties included in Annex I to the Convention, decision 3/CP.1 on preparation and submission of national communications from the Parties included in Annex I to the Convention, decision 4/CP.1 on methodological issues and decision 9/CP.2 on the guidelines, schedule and process for consideration of communications from Parties included in Annex I to the Convention,

Having considered the relevant recommendations of the Subsidiary Body for Scientific and Technological Advice and those of the Subsidiary Body for Implementation,

1. *Calls upon* the Parties included in Annex I to the Convention (Annex I Parties), when submitting annually national greenhouse gas inventories, to follow the relevant parts of the revised UNFCCC guidelines for the preparation of national communications by Annex I Parties, as well as the relevant conclusions of the fourth session of the Subsidiary Body for Scientific and Technological Advice;

2. *Requests* the Convention secretariat:

(a) To prepare a full compilation and synthesis of second national communications from Annex I Parties for consideration at its fourth session;

(b) To collect, process and publish, on a regular basis, national greenhouse gas inventories submitted annually by Annex I Parties in accordance with decision 9/CP.2. In those years when the compilation and synthesis of national communications is prepared inventory data should be included. Publication of inventory data may be accompanied by relevant documentation prepared by the secretariat, for example, on evaluating compliance with the Intergovernmental Panel on Climate Change guidelines or addressing methodological or other issues related to reporting greenhouse gas emissions. It may also include or refer to relevant data from authoritative sources;

3. *Decides* that:

(a) In-depth reviews of second national communications from Annex I Parties should, as a general rule, include visits of review teams co-ordinated by the secretariat, based on the schedule of these reviews and on a visit programme agreed between the host countries and the secretariat. Parties concerned are urged to submit their comments on the draft in-depth review reports produced by the review teams, if possible not later than eight weeks following receipt of the drafts;

(b) Executive summaries of national communications will be published in their original language as official UNFCCC documents, and also translated into the other official languages of the United Nations if they are less than 15 pages long in standard format. Full texts of the in-depth review reports will be published as official UNFCCC documents and translated into the other official languages of the United Nations.

2nd plenary meeting
1 December 1997

Decision 7/CP.3

Cooperation with the Intergovernmental Panel on Climate Change

The Conference of the Parties,

Reaffirming its decision 6/CP.2, paragraph 5, in which it urged continuing cooperation between the Convention bodies and the Intergovernmental Panel on Climate Change,

1. *Expresses* appreciation to the Intergovernmental Panel on Climate Change for its contribution to the Convention process, particularly through its prompt response to requests from the Subsidiary Body for Scientific and Technological Advice for technical papers, special reports and Guidelines for National Greenhouse Gas Inventories, as well as for its plans for the preparation of the Third Assessment Report; and, in this connection, *requests* the Subsidiary Body for Scientific and Technological Advice to give further consideration to issues related to the work of the Intergovernmental Panel on Climate Change and to formulate policy-relevant questions which should be addressed in the Third Assessment Report;

2. *Thanks* the Chairman Emeritus of the Intergovernmental Panel on Climate Change, Professor Bert Bolin, for his outstanding work and his valuable scientific contribution to the Convention process;

3. *Invites* the subsidiary bodies of the Convention, in particular the Subsidiary Body for Scientific and Technological Advice, to continue their cooperation with the Intergovernmental Panel on Climate Change.

2nd plenary meeting
1 December 1997

Decision 8/CP.3

Development of observational networks of the climate system

The Conference of the Parties,

Recalling Article 4.1(g) and Article 5 of the United Nations Framework Convention on Climate Change,

Noting the importance of the observations, analysis and research relevant to the various components of the climate system,

1. *Expresses* appreciation of the work carried out by the relevant intergovernmental organizations, particularly the development of such observational programmes as the Global Climate Observing System, the Global Ocean Observing System and the Global Terrestrial Observing System;

2. *Recognizes* the concerns raised by the relevant intergovernmental organizations with regard to the long-term sustainability of these observational systems;

3. *Urges* Parties to provide the necessary resources to reverse the decline in the existing observational networks and to support the regional and global observational systems being developed under the Global Climate Observing System, the Global Ocean Observing System and the Global Terrestrial Observing System, through appropriate funding mechanisms;

4. *Requests* the Subsidiary Body for Scientific and Technological Advice, with the assistance of the secretariat and in consultation with the Intergovernmental Panel on Climate Change, to consider the adequacy of these observational systems and to report on its conclusions to the Conference of the Parties at its fourth session.

2nd plenary meeting
1 December 1997

Decision 9/CP.3

Development and transfer of technologies

The Conference of the Parties,

Recalling the relevant provisions of the programme for the further implementation of Agenda 21 on the transfer of environmentally sound technologies adopted by the United Nations General Assembly at its nineteenth special session,

Noting the role of the public and private sectors in developing and disseminating environmentally sound and economically viable technologies related to the mitigation of, and adaptation to, climate change,

Recognizing the progress made by countries in fostering the institutional and regulatory environment necessary for the introduction of environmentally sound technologies and the need for continued efforts by Parties to remove existing market barriers to technology dissemination,

Recalling its decisions 13/CP.1 and 7/CP.2 on transfer of technology,

Having considered the progress reports presented by the Convention secretariat on the development and transfer of technology,[1]

1. *Reaffirms* its decisions 13/CP.1 and 7/CP.2 on transfer of technology;

2. *Requests* the Convention secretariat:

(a) To continue its work on the synthesis and dissemination of information on environmentally sound technologies and know-how conducive to mitigating, and adapting to, climate change; for example, by accelerating the development of methodologies for adaptation technologies, in particular decision tools to evaluate alternative adaptation strategies, bearing in mind the work programme on methodological issues approved by the Subsidiary Body for Scientific and Technological Advice at its sixth session;[2]

(b) To consult with the Global Environment Facility and other relevant international organizations, and solicit information on their capabilities and abilities to support the work of (an) international technology information centre(s), as well as national and regional centres, and to enhance support for national and regional centres, and to report to the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation on its findings;

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[1] FCCC/SB/1997/1, 3 and 4; and FCCC/SBSTA/1997/10.

[2] FCCC/SBSTA/1997/6, section IV, A.

(c) To consider specific case studies, as part of its work on terms of transfer of technologies, drawing on the experience of Parties, including demonstration projects, with the aim of evaluating barriers to the introduction and implementation of environmentally sound technologies and know-how, and of promoting their practical application;

3. *Requests* the Subsidiary Body for Implementation to consider options for funding (an) international technology information centre(s) and enhancing support for national or regional centres;

4. *Requests* the Subsidiary Body for Scientific and Technological Advice to forward any conclusions regarding technology information centres and enhancing support for national or regional centres to the Subsidiary Body for Implementation for consideration;

5. *Urges* Parties:

(a) To create an enabling environment to help further stimulate private-sector investment in, and transfer of, environmentally sound technologies; and

(b) To improve reporting in national communications on technology needs and technology transfer activities, as indicated in the reporting guidelines adopted by the Parties.

2nd plenary meeting
1 December 1997

Decision 10/CP.3

Activities implemented jointly under the pilot phase

The Conference of the Parties,

Acknowledging the contributions of the Parties which submitted reports on activities implemented jointly under the pilot phase,

Noting the progress made in the pilot phase as evidenced in the synthesis report on activities implemented jointly[1] and the concise update on contact and activity information,[2]

1. *Takes note* of the synthesis report on activities implemented jointly;[1]

2. *Reaffirms* its decision 5/CP.1 on activities implemented jointly under the pilot phase;

3. *Adopts* the uniform reporting format contained in the report of the Subsidiary Body for Scientific and Technological Advice on the work of its fifth session,[3] and *invites* Parties to report in accordance with that format and to provide inputs to the secretariat on their experience in using it, so that, if necessary, changes can be incorporated.

2nd plenary meeting
1 December 1997

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[1] FCCC/SBSTA/1997/12 and Corr.1-2, and Add.1.

[2] FCCC/SBSTA/1997/INF.3.

[3] FCCC/SBSTA/1997/4.

Decision 11/CP.3

Review of the financial mechanism

The Conference of the Parties

1. *Takes note of* the review process undertaken by the Subsidiary Body for Implementation in accordance with decision 11/CP.2;

2. *Decides* to continue the review process through the Subsidiary Body for Implementation, in accordance with the criteria established in the guidelines adopted by the Subsidiary Body for Implementation at its fifth session;[1]

3. *Reaffirms* its decision 9/CP.1;

4. *Requests* the secretariat to report to the Subsidiary Body for Implementation in accordance with paragraph 2 above.

2nd plenary meeting
1 December 1997

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[1] FCCC/SBI/1997/6, annex II.

Decision 12/CP.3

Annex to the Memorandum of Understanding on the determination of funding necessary and available for the implementation of the Convention

The Conference of the Parties

1. *Takes note* of the approval by the Council of the Global Environment Facility of the annex to the Memorandum of Understanding between the Conference of the Parties and the Council of the Global Environment Facility;

2. *Decides* to approve the annex to the Memorandum of Understanding, thereby bringing it into force.

2nd plenary meeting
1 December 1997

Decision 13/CP.3

Division of labour between the Subsidiary Body for Implementation and the Subsidiary Body for Scientific and Technological Advice

The Conference of the Parties,

Recalling Articles 9 and 10 of the United Nations Framework Convention on Climate Change,

Recalling also its decision at its second session that the question of the division of labour between the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation should be taken up by the Conference of the Parties at its third session on the basis of recommendations made to it by the Chairmen of the two subsidiary bodies,[1]

Having considered the recommendations made by the Chairmen, through the conclusions of the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation, as included in the reports of their sixth sessions,[2]

Desiring to elaborate further the division of labour between the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation,

1. *Reaffirms* that the division of labour is governed by Articles 9 and 10 of the Convention, and by decision 6/CP.1 and other relevant decisions of the Conference of the Parties;

2. *Recalls* that, as indicated in decision 6/CP.1, the role of the subsidiary bodies can be broadly characterized as follows:

(a) The Subsidiary Body for Scientific and Technological Advice will be the link between the scientific, technical and technological assessments and the information provided by competent international bodies, and the policy-oriented needs of the Conference of the Parties;

(b) The Subsidiary Body for Implementation will develop recommendations to assist the Conference of the Parties in its review and assessment of the implementation of the Convention and in the preparation and implementation of its decisions;

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[1] FCCC/CP/1996/15/Add.1, section III, 4.

[2] FCCC/SBSTA/1997/6 and FCCC/SBI/1997/16.

3. *Decides* that the consideration of issues which are pertinent to both bodies should take place in a way which is efficient in the use of time during meetings, in order to avoid confusion and to reduce the overall workload. Therefore, in general, one of the bodies will take the overall responsibility in considering an issue. If necessary, it will request adequate and specific inputs from the other body. Where overall responsibility is not assigned, agendas should be organized to ensure that the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation avoid dealing with such issues in parallel sessions. On issues where this is not possible, consideration should be given to holding ad hoc joint sessions of the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation. On this basis, the provisions above are clarified as follows:

National communications from Parties

(a) The Subsidiary Body for Implementation will have the overall responsibility for:

(i) Developing guidelines on the processes for consideration of national communications;

(ii) Considering the information contained in national communications, other relevant documentation and compilation and synthesis reports, with a view to assisting the Conference of the Parties in undertaking its tasks under Article 7.2(e) of the Convention;

(b) In co-operation with the Subsidiary Body for Implementation, the Subsidiary Body for Scientific and Technological Advice will have responsibility for:

(i) Developing guidelines for the provision of comparable information, including all related methodological issues;

(ii) Considering, upon the request of the Subsidiary Body for Implementation, as appropriate, national communications and other relevant documentation, such as technical papers, with the aim of, *inter alia*, verifying methodologies used and making recommendations on their refinement, preparing scientific assessments on the effects of measures taken in the implementation of the Convention, reviewing projections and their assumptions, and assessing the comprehensiveness and effectiveness of mitigation and adaptation measures;

Development and transfer of technology

(c) The Subsidiary Body for Implementation will, with inputs from the Subsidiary Body for Scientific and Technological Advice as appropriate, have responsibilities for assisting the

Conference of the Parties in the assessment and review of the effective implementation of the Convention with respect to the development and transfer of technology;

(d) As stipulated in the Convention, and as decided by the Conference of the Parties in decision 6/CP.1, the Subsidiary Body for Scientific and Technological Advice will have responsibility for providing advice on all scientific, technological and methodological aspects of the development and transfer of technology;

Consultations with non-governmental organizations

(e) Taking into account the competence of each subsidiary body, the Subsidiary Body for Implementation will have overall responsibility for all policy questions and relevant inputs related to issues dealing with consultation with non-governmental organizations, as appropriate;

(f) Should the Subsidiary Body for Scientific and Technological Advice or any other subsidiary body feel that non-governmental organizations could provide relevant inputs on an item being considered, that body could seek and consider such inputs;

(g) Provisional accreditation of individual non-governmental organizations will be the responsibility of the body concerned;

Activities implemented jointly

(h) The Subsidiary Body for Scientific and Technological Advice will have the responsibility for:

> (i) Developing the framework for reporting, including consideration of scientific, technical and methodological aspects of the reports;
>
> (ii) Preparing a synthesis report of activities for the Conference of the Parties;

(i) The Subsidiary Body for Implementation will have the responsibility for assisting the Conference of the Parties in reviewing the progress of the activities implemented jointly under the pilot phase, on the basis of inputs by the Subsidiary Body for Scientific and Technological Advice;

Research and systematic observation

(j) In accordance with Article 5 of the Convention, the Subsidiary Body for Scientific and Technological Advice will have the overall responsibility for issues related to research and systematic observation, drawing, where necessary, upon the Subsidiary Body for Implementation. The Subsidiary Body for Scientific and Technological Advice will also play a co-ordinating role in such activities related to climate change relevant to the implementation of the Convention;

(k) The Subsidiary Body for Implementation, with inputs from the Subsidiary Body for Scientific and Technological Advice as appropriate, will have the responsibility for assisting the Conference of the Parties in the assessment and review of the effective implementation of the Convention with respect to research and systematic observation;

Education, training and public awareness

(l) In further clarification of decision 6/CP.1, the Subsidiary Body for Scientific and Technological Advice will have the overall responsibility for providing advice on educational, training and public awareness programmes, as well as public access to information. When considering such issues, the Subsidiary Body for Scientific and Technological Advice will draw upon, *inter alia*, relevant international organizations;

(m) The Subsidiary Body for Implementation, with inputs from the Subsidiary Body for Scientific and Technological Advice as appropriate, will have responsibility for assisting the Conference of the Parties in the assessment and review of the effective implementation of the Convention with respect to education, training, and public awareness.

2nd plenary meeting
1 December 1997

Decision 14/CP.3

Future work of the Ad Hoc Group on Article 13

The Conference of the Parties,

Recalling Article 13 of the United Nations Framework Convention on Climate Change, and decisions 20/CP.1 and 4/CP.2,

Having considered the report of the Ad Hoc Group on Article 13 on the work of its fifth session,[1] at which the Group agreed on a set of functions and procedures that could serve as a basis for further discussion in its consideration of a multilateral consultative process and its design,

Taking note that the Ad Hoc Group on Article 13 could not complete its work before the third session of the Conference of the Parties,

1. *Decides*, pursuant to its decision 4/CP.2, that the work of the Ad Hoc Group on Article 13 should continue beyond the third session of the Conference of the Parties;

2. *Invites* the Group to complete its work before the fourth session of the Conference of the Parties and, pursuant to decision 20/CP.1, provide the Conference of the Parties with a report on its findings;

3. *Requests* the Group to report to the Conference of the Parties at its fourth session on the progress of its work, if its work has not been completed by that time.

2nd plenary meeting
1 December 1997

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[1] FCCC/AG13/1997/4.

Decision 15/CP.3

Programme budget for the biennium 1998-1999

The Conference of the Parties,

Recalling paragraph 4 of the financial procedures for the Conference of the Parties,

Having considered the proposed budget for the biennium 1998-1999 submitted by the Executive Secretary,[1]

Noting the annual contribution of the host Government, DM 1.5 million, which offsets planned expenditures,

1. *Approves* the programme budget for the biennium 1998-1999, amounting to $ 21,345,900,[2] for the purposes specified in table 1 below;

2. *Approves* the staffing table for the programme budget, including the post of the Executive Secretary at the level of Assistant Secretary-General and two other senior posts at the level of D-2, as contained in table 2 below;

3. *Approves* a contingency budget for conference servicing, amounting to $ 5,184,900, to be added to the programme budget for the coming biennium in the event that the General Assembly of the United Nations decides not to provide resources for these activities in the regular United Nations budget for the biennium 1998-1999 (see table 3 below);[3]

4. *Requests* the Executive Secretary to report to the Subsidiary Body for Implementation at its eighth session on the implementation of paragraph 3 above, and on the deployment of staff and financial resources to perform the tasks arising from the decision to adopt the Kyoto Protocol;

5. *Authorizes* the Executive Secretary to make transfers, between each of the main

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[1] FCCC/SBI/1997/10. In this connection, see also document FCCC/CP/1997/INF.1.

[2] This figure would be offset by the annual contributions of the host Government, amounting to DM 3 million, resulting in a net figure of $ 19,570,700 to be met in the form of contributions from Parties.

[3] By its resolution 52/119 (dated 18 December 1997), the General Assembly of the United Nations decided to include eight weeks of conference-servicing facilities for the Conference of the Parties and its subsidiary bodies in its calendar of conferences and meetings for the biennium 1998-1999. As a result, the contingency budget for conference servicing will not be included in the UNFCCC programme budget for the same biennium.

appropriation lines set out in table 1 below, up to an aggregate limit of 15 per cent of total estimated expenditure for those appropriation lines, provided that a further limitation of up to minus 25 per cent of each such appropriation line shall apply;

6. *Decides* to maintain the level of the working capital reserve at 8.3 per cent of the estimated expenditure;

7. *Invites* all Parties to the Convention to note that contributions to the core budget are due on 1 January of each year in accordance with paragraph 8(b) of the financial procedures and to pay promptly and in full, for each of the years 1998 and 1999, the contributions required to finance expenditures approved under paragraph 1 above, as offset by estimated contributions noted under the third paragraph of the preamble to this decision, and the contributions which may result from the decision of the General Assembly referred to in paragraph 3 above;

8. *Takes note* of the funding estimates for the Trust Fund for Participation in the United Nations Framework Convention on Climate Change Process and the Trust Fund for Supplementary Activities under the United Nations Framework Convention on Climate Change specified by the Executive Secretary and included in table 5 below, and *invites* Parties to make contributions to these funds;

9. *Requests* the Executive Secretary to report to the Conference of the Parties at its fourth session on income and budget performance, and to propose any adjustments that might be needed in the Convention budget for the biennium 1998-1999.

Table 1: Programme budget for the biennium 1998-1999 (US$ thousand)

Expenditures	**1998**	**1999**
I. Programmes		
Executive Direction and Management	621.3	642.8
Science and Technology	2,223.1	2,779.4
Implementation	2,333.6	2,553.0
Conference and Information Support	1,500.1	1,901.2
Resources, Planning and Coordination	1,599.5	1,807.6
Activities related to the Kyoto Protocol	242.3	462.9
Subtotal (I)	8,519.8	10,146.9
II. Payments to the United Nations		
Overhead charge[a]	1,107.6	1,319.1
Subtotal (II)	1,107.6	1,319.1
III. Working capital reserve[b]	99.7	152.6
Subtotal (III)	99.7	152.6
Total expenditure (I+II+III)	9,727.1	11,618.6
Income		
Contribution from the host Government	887.6	887.6
Total income	887.6	887.6
NET TOTAL	8,839.5	10,731

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[a] Standard 13 per cent applied by the United Nations for administrative support.

[b] In accordance with paragraph 14 of the financial procedures (see decision 15/CP.1). This will bring the level of the working capital reserve to $799,100 in 1998 and $951,700 in 1999 (see paragraphs 17-19 of the financial procedures).

Table 2: Programme budget staffing table 1998-1999

		1998	1999
A.	Professional category and above		
	Executive Secretary	1	1
	D-2	2	2
	D-1	3.83	5
	P-5	5.75	6
	P-4	7.5	8
	P-3	9.5	12
	P-2	4.25	5
	Subtotal (A)	33.83	39
B.	General Service category	21	23
	Subtotal (B)	21	23
	TOTAL (A+B)	54.83	62

Table 3: Resource requirements for the conference servicing contingency (US$ thousand)

Item of expenditure		**1998**	**1999**
I.	Meeting servicing[a]	419.4	431.5
II.	Documentation[b]	698.5	737.4
III.	Other requirements[c]	707.5	728.1
IV.	Travel of staff to meetings[d]	265.5	265.5
V.	Miscellaneous[e]	10.5	10.5
VI.	Contingencies and exchange rate fluctuation	63.0	65.2
	Subtotal	2,164.4	2,238.2
VII.	Overhead charge[f]	281.4	291.0
VIII.	Working Capital Reserve[g]	203.0	6.9
TOTAL		2,648.8	2536.1

Table 4: Staffing requirements for the conference servicing contingency

	1998	**1999**
A. Professional category and above		
P-4	1	1
Subtotal (A)	1	1
B. General Service category	4	4
Subtotal (B)	4	4
TOTAL (A+B)	5	5

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[a] Includes interpretation and meeting room staff.

[b] Includes revision, translation, typing, reproduction and distribution of pre-, in- and post-session documentation.

[c] Includes remote translation requirements, key supervisory staff, freight, communications.

[d] Includes travel of interpreters and key supervisory staff, including planning missions.

[e] Includes estimated cost of initial stock of meeting stationery and supplies.

[f] Standard 13 per cent applied by the United Nations for administrative support.

[g] In accordance with paragraph 14 of the financial procedures. The 1998 amount has been calculated as 8.3 per cent of the subtotal of I-VII; the 1999 amount has been calculated as the amount required to bring the carried-over 1998 reserve to 8.3 per cent of the subtotal of I-VII for 1999.

Table 5: Summary of other voluntary funding resource estimates for the biennium 1998-1999 (US$ thousand)

Proposed source of funding	**1998**	**1999**
Trust Fund for Participation in the UNFCCC Process	2,256.1	2,324.4
Trust Fund for Supplementary Activities	2,062.6	2,086.2
TOTAL	4,318.7	4,410.6

12th plenary meeting
11 December 1997

Decision 16/CP.3

Financial performance of the Convention in the biennium 1996-1997

The Conference of the Parties,

Recalling its decision 16/CP.2, paragraph 14, whereby it requested the Executive Secretary to submit to the Conference of the Parties at its third session a further report on financial performance for the biennium 1996-1997,

Recalling also the financial rules for the Conference of the Parties,

1. *Takes note* of the information provided in documents FCCC/SBI/1997/18 and FCCC/SBI/1997/INF.7;

2. *Approves* the creation of a new trust fund for the special annual contribution of DM 3.5 million from the Government of Germany to finance events in Germany, made in accordance with the bilateral arrangements between the Government of Germany and the Convention secretariat, and *requests* the Executive Secretary to request the Secretary-General of the United Nations to establish the new trust fund, to be managed by the Executive Secretary;

3. *Urges* Parties that have still not paid their 1996 and/or 1997 contributions to the core budget to do so without delay;

4. *Requests* the Executive Secretary to submit to the Conference of the Parties at its fourth session, through the Subsidiary Body for Implementation, as appropriate, a final report on financial performance in the biennium 1996-1997, including audited financial statements, and an initial report on financial performance in 1998;

5. *Approves* transfers between the main appropriation lines to cover over-expenditures, for the Policy-making organs programme and the Implementation and planning programme, in excess of the 15 per cent transfer within each of the main appropriation lines that the Executive Secretary is at present authorized to make.[1]

2nd plenary meeting
1 December 1997

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[1] See decision 17/CP.1, para. 5.

Decision 17/CP.3

Arrangements for administrative support to the Convention secretariat

The Conference of the Parties,

Recalling the arrangements proposed by the Secretary-General of the United Nations for administrative support to the Convention secretariat,[1] provisionally accepted by the Conference of the Parties at its first session by its decision 14/CP.1,

1. *Takes note* of the information contained in document FCCC/SBI/1997/INF.2;

2. *Requests* the Executive Secretary to continue his discussions with the United Nations regarding administrative arrangements for the Convention, and to inform the Conference of the Parties, through the Subsidiary Body for Implementation, as appropriate, of any significant developments.

2nd plenary meeting
1 December 1997

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[1] FCCC/CP/1995/5/Add.4.

Decision 18/CP.3

Volume of documentation

The Conference of the Parties,

Recalling its decision 17/CP.2, paragraph 2, whereby it requested the Executive Secretary to submit to the Subsidiary Body for Implementation, at its fifth session, further options for reducing the cost of documentation for the meetings of the Conference of the Parties and its subsidiary bodies,

1. *Takes note* of the efforts of the Convention secretariat to reduce the volume of documentation, as indicated in the note by the secretariat on volume of documentation;[1]

2. *Requests* the Executive Secretary to explore with the United Nations the possibility of ensuring unrestricted access to all language versions of the documents of the United Nations Framework Convention on Climate Change that the United Nations makes available on its optical disk system through a restricted page on the World Wide Web;

3. *Invites* the Parties:

(a) To limit the volume of their submissions for circulation to Convention bodies, including those that do not require translation;

(b) To focus the content of submissions on material pertinent to the forthcoming sessions of the subsidiary bodies and to seek to avoid repetition of previously presented statements;

(c) To limit their requests for numbers of hard copies of documents;

(d) To limit the requests for documents that need to be translated;

(e) To schedule the delivery of documents in a timely manner that corresponds to the capacity of the Convention bodies to consider them;

4. *Notes* the intention of the Executive Secretary to advise presiding officers on the feasibility of producing, in a timely manner, the documentation envisaged in the conclusions of subsidiary bodies, before those conclusions are adopted.

2nd plenary meeting
1 December 1997

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[1] FCCC/SBI/1997/12, paras. 9-10.

II. RESOLUTION ADOPTED BY THE CONFERENCE OF THE PARTIES

Resolution 1/CP.3

Expression of gratitude to the Government and people of Japan

The Conference of the Parties,

Having met in Kyoto from 1 to 11 December 1997 at the invitation of the Government of Japan,

1. *Expresses its profound gratitude* to the Government of Japan for having made it possible for the third session of the Conference of the Parties to be held in Kyoto and for the excellent facilities, staff and services so graciously placed at its disposal;

2. *Requests* the Government of Japan to convey to the Prefecture and City of Kyoto, and to the people of Japan, the gratitude of the Conference of the Parties for the hospitality and warm welcome extended to the participants.

12th plenary meeting
11 December 1997

III. OTHER ACTION TAKEN BY THE CONFERENCE OF THE PARTIES

1. Second review of the adequacy of Article 4.2(a) and (b) of the Convention

At its 3rd plenary meeting, on 3 December 1997, the Conference of the Parties decided to place the issue of the second review of the adequacy of Article 4.2(a) and (b) of the Convention on the agenda for its fourth session, and to request the subsidiary bodies and the secretariat to make all necessary preparations to facilitate future consideration of that item (see Part One, section III D, para. 63 of the present report).

2. Request by Turkey to be deleted from the lists in Annexes I and II to the Convention

At its 12th plenary meeting, on 11 December 1997, the Conference of the Parties requested the Subsidiary Boy for Implementation, at its eighth session, to consider the request to delete the name of Turkey from the lists in Annexes I and II to the Convention, and to present a report to the Conference of the Parties at its fourth session for consideration and definitive action (see Part One, section III E, para. 68 of the present report).

3. Proposal by Brazil in document FCCC/AGBM/1997/MISC.1/Add.3

At its 5th plenary meeting, on 5 December 1997, the Conference of the Parties decided that the proposal presented by Brazil in document FCCC/AGBM/1997/MISC.1/Add.3 should be referred to the Subsidiary Body for Scientific and Technological Advice for its advice regarding the methodological and scientific aspects. It authorized the Subsidiary Body for Scientific and Technological Advice to seek inputs, as appropriate, from its roster of experts and from the Intergovernmental Panel on Climate Change, and requested it to make its advice available to the Conference of the Parties at its fourth session (see Part One, section III F, para. 69 of the present report).

4. Calendar of meetings of Convention bodies 1998-1999

At its 5th plenary meeting, on 5 December 1997, the Conference of the Parties adopted the following calendar of meetings of Convention bodies in 1998-1999 (see Part One, section II G, para. 35 of the present report):

1. First sessional period in 1998: from 2 to 12 June;

2. Second sessional period in 1998: from 2 to 13 November;

3. First sessional period in 1999: from 31 May to 11 June;

4. Second sessional period in 1999: from 25 October to 5 November.

Annex

Table: Total carbon dioxide emissions of Annex I Parties in 1990, for the purposes of Article 25 of the Kyoto Protocol [a]

Party	Emissions (Gg)	Percentage
Australia	288,965	2.1
Austria	59,200	0.4
Belgium	113,405	0.8
Bulgaria	82,990	0.6
Canada	457,441	3.3
Czech Republic	169,514	1.2
Denmark	52,100	0.4
Estonia	37,797	0.3
Finland	53,900	0.4
France	366,536	2.7
Germany	1,012,443	7.4
Greece	82,100	0.6
Hungary	71,673	0.5
Iceland	2,172	0.0
Ireland	30,719	0.2
Italy	428,941	3.1
Japan	1,173,360	8.5
Latvia	22,976	0.2
Liechtenstein	208	0.0
Luxembourg	11,343	0.1
Monaco	71	0.0
Netherlands	167,600	1.2
New Zealand	25,530	0.2
Norway	35,533	0.3
Poland	414,930	3.0
Portugal	42,148	0.3
Romania	171,103	1.2
Russian Federation	2,388,720	17.4
Slovakia	58,278	0.4
Spain	260,654	1.9
Sweden	61,256	0.4
Switzerland	43,600	0.3
United Kingdom of Great Britain and Northern Ireland	584,078	4.3
United States of America	4,957,022	36.1
Total	**13,728,306**	**100.0**

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[a] Data based on the information from the 34 Annex I Parties that submitted their first national communications on or before 11 December 1997, as compiled by the secretariat in several documents (A/AC.237/81; FCCC/CP/1996/12/Add.2 and FCCC/SB/1997/6). Some of the communications included data on CO2 emissions by sources and removals by sinks from land-use change and forestry, but since different ways of reporting were used these data are not included.

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UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The Parties to this Convention,

Acknowledging that change in the Earth's climate and its adverse effects are a common concern of humankind,

Concerned that human activities have been substantially increasing the atmospheric concentrations of greenhouse gases, that these increases enhance the natural greenhouse effect, and that this will result on average in an additional warming of the Earth's surface and atmosphere and may adversely affect natural ecosystems and humankind,

Noting that the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs,

Aware of the role and importance in terrestrial and marine ecosystems of sinks and reservoirs of greenhouse gases,

Noting that there are many uncertainties in predictions of climate change, particularly with regard to the timing, magnitude and regional patterns thereof,

Acknowledging that the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions,

Recalling the pertinent provisions of the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972,

Recalling also that States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction,

Reaffirming the principle of sovereignty of States in international cooperation to address climate change,

Recognizing that States should enact effective environmental legislation, that environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply, and that standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries, Recalling the provisions of General Assembly resolution 44/228 of 22 December 1989 on the United Nations Conference on Environment and Development, and resolutions 43/53 of 6 December 1988, 44/207 of 22 December 1989, 45/212 of 21 December 1990 and 46/169 of 19 December 1991 on protection of global climate for present and future generations of mankind,

Recalling also the provisions of General Assembly resolution 44/206 of 22 December 1989 on the possible adverse effects of sea-level rise on islands and coastal areas, particularly low-lying coastal areas and the pertinent provisions of General Assembly resolution 44/172 of 19 December 1989 on the implementation of the Plan of Action to Combat Desertification,

Recalling further the Vienna Convention for the Protection of the Ozone Layer, 1985, and the Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, as adjusted and amended on 29 June 1990,

Noting the Ministerial Declaration of the Second World Climate Conference adopted on 7 November 1990,

Conscious of the valuable analytical work being conducted by many States on climate change and of the important contributions of the World Meteorological Organization, the United Nations Environment Programme and other organs, organizations and bodies of the United Nations system, as well as other international and intergovernmental bodies, to the exchange of results of scientific research and the coordination of research,

Recognizing that steps required to understand and address climate change will be environmentally, socially and economically most effective if they are based on relevant scientific, technical and economic considerations and continually re-evaluated in the light of new findings in these areas,

Recognizing that various actions to address climate change can be justified economically in their own right and can also help in solving other environmental problems,

Recognizing also the need for developed countries to take immediate action in a flexible manner on the basis of clear priorities, as a first step towards comprehensive response strategies at the global, national and, where agreed, regional levels that take into account all greenhouse gases, with due consideration of their relative contributions to the enhancement of the greenhouse effect,

Recognizing further that low-lying and other small island countries, countries with low-lying coastal, arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change, Recognizing the special difficulties of those countries, especially developing countries, whose economies are particularly dependent on fossil fuel production, use and exportation, as a consequence of action taken on limiting greenhouse gas emissions,

Affirming that responses to climate change should be coordinated with social and economic development in an integrated manner with a view to avoiding adverse impacts on the latter, taking into full account the legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty,

Recognizing that all countries, especially developing countries, need access to resources required to achieve sustainable social and economic development and that, in order for developing countries to progress towards that goal, their energy consumption will need to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general, including through the application of new technologies on terms which make such an application economically and socially beneficial,

Determined to protect the climate system for present and future generations,

Have agreed as follows:

ARTICLE 1: DEFINITIONS[*]

For the purposes of this Convention:

1. "Adverse effects of climate change" means changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.

2. "Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

3. "Climate system" means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.

4. "Emissions" means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time.

5. "Greenhouse gases" means those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.

6. "Regional economic integration organization" means an organization constituted by sovereign States of a given region which has competence in respect of matters governed by this Convention

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[*] Titles of articles are included solely to assist the reader.

or its protocols and has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve or accede to the instruments concerned.

7. "Reservoir" means a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored.

8. "Sink" means any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.

9. "Source" means any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.

ARTICLE 2: OBJECTIVE

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

ARTICLE 3: PRINCIPLES

In their actions to achieve the objective of the Convention and to implement its provisions, the Parties shall be guided, inter alia, by the following:

1. The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.

2. The specific needs and special circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change, and of those Parties, especially developing country Parties, that would have to bear a disproportionate or abnormal burden under the Convention, should be given full consideration.

3. The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost. To achieve this, such policies and measures should take into account different socio-economic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and

adaptation, and comprise all economic sectors. Efforts to address climate change may be carried out cooperatively by interested Parties.

4. The Parties have a right to, and should, promote sustainable development. Policies and measures to protect the climate system against human-induced change should be appropriate for the specific conditions of each Party and should be integrated with national development programmes, taking into account that economic development is essential for adopting measures to address climate change.

5. The Parties should cooperate to promote a supportive and open international economic system that would lead to sustainable economic growth and development in all Parties, particularly developing country Parties, thus enabling them better to address the problems of climate change. Measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade.

ARTICLE 4: COMMITMENTS

1. All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:

(a) Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties;

(b) Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change;

(c) Promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors;

(d) Promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems;

(e) Cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods;

(f) Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change;

(g) Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of climate change and the economic and social consequences of various response strategies;

(h) Promote and cooperate in the full, open and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate system and climate change, and to the economic and social consequences of various response strategies;

(i) Promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process, including that of non-governmental organizations; and

(j) Communicate to the Conference of the Parties information related to implementation, in accordance with Article 12.

2. The developed country Parties and other Parties included in Annex I commit themselves specifically as provided for in the following:

(a) Each of these Parties shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. These policies and measures will demonstrate that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objective of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol would contribute to such modification, and taking into account the differences in these Parties' starting points and approaches, economic structures and resource bases, the need to maintain strong and sustainable economic growth, available technologies and other individual circumstances, as well as the need for equitable and appropriate contributions by each of these Parties to the global effort regarding that objective. These Parties may implement such policies and measures jointly with other

Parties and may assist other Parties in contributing to the achievement of the objective of the Convention and, in particular, that of this subparagraph;

(b) In order to promote progress to this end, each of these Parties shall communicate, within six months of the entry into force of the Convention for it and periodically thereafter, and in accordance with Article 12, detailed information on its policies and measures referred to in subparagraph (a) above, as well as on its resulting projected anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for the period referred to in subparagraph (a), with the aim of returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol. This information will be reviewed by the Conference of the Parties, at its first session and periodically thereafter, in accordance with Article 7;

(c) Calculations of emissions by sources and removals by sinks of greenhouse gases for the purposes of subparagraph (b) above should take into account the best available scientific knowledge, including of the effective capacity of sinks and the respective contributions of such gases to climate change. The Conference of the Parties shall consider and agree on methodologies for these calculations at its first session and review them regularly thereafter;

(d) The Conference of the Parties shall, at its first session, review the adequacy of subparagraphs (a) and (b) above. Such review shall be carried out in the light of the best available scientific information and assessment on climate change and its impacts, as well as relevant technical, social and economic information. Based on this review, the Conference of the Parties shall take appropriate action, which may include the adoption of amendments to the commitments in subparagraphs (a) and (b) above. The Conference of the Parties, at its first session, shall also take decisions regarding criteria for joint implementation as indicated in subparagraph (a) above. A second review of subparagraphs (a) and (b) shall take place not later than 31 December 1998, and thereafter at regular intervals determined by the Conference of the Parties, until the objective of the Convention is met;

(e) Each of these Parties shall :

   (i) Coordinate as appropriate with other such Parties, relevant economic and administrative instruments developed to achieve the objective of the Convention; and

   (ii) Identify and periodically review its own policies and practices which encourage activities that lead to greater levels of anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol than would otherwise occur;

(f) The Conference of the Parties shall review, not later than 31 December 1998, available information with a view to taking decisions regarding such amendments to the lists in Annexes I and II as may be appropriate, with the approval of the Party concerned;

(g) Any Party not included in Annex I may, in its instrument of ratification, acceptance, approval or accession, or at any time thereafter, notify the Depositary that it intends to be bound by subparagraphs (a) and (b) above. The Depositary shall inform the other signatories and Parties of any such notification.

3. The developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1. They shall also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measures that are covered by paragraph 1 of this Article and that are agreed between a developing country Party and the international entity or entities referred to in Article 11, in accordance with that Article. The implementation of these commitments shall take into account the need for adequacy and predictability in the flow of funds and the importance of appropriate burden sharing among the developed country Parties.

4. The developed country Parties and other developed Parties included in Annex II shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects.

5. The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties. Other Parties and organizations in a position to do so may also assist in facilitating the transfer of such technologies.

6. In the implementation of their commitments under paragraph 2 above, a certain degree of flexibility shall be allowed by the Conference of the Parties to the Parties included in Annex I undergoing the process of transition to a market economy, in order to enhance the ability of these Parties to address climate change, including with regard to the historical level of anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol chosen as a reference.

7. The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties.

8. In the implementation of the commitments in this Article, the Parties shall give full consideration to what actions are necessary under the Convention, including actions related to funding, insurance and the transfer of technology, to meet the specific needs and concerns of

developing country Parties arising from the adverse effects of climate change and/or the impact of the implementation of response measures, especially on:

(a) Small island countries;

(b) Countries with low-lying coastal areas;

(c) Countries with arid and semi-arid areas, forested areas and areas liable to forest decay;

(d) Countries with areas prone to natural disasters;

(e) Countries with areas liable to drought and desertification;

(f) Countries with areas of high urban atmospheric pollution;

(g) Countries with areas with fragile ecosystems, including mountainous ecosystems;

(h) Countries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-intensive products; and

(i) Land-locked and transit countries.

Further, the Conference of the Parties may take actions, as appropriate, with respect to this paragraph.

9. The Parties shall take full account of the specific needs and special situations of the least developed countries in their actions with regard to funding and transfer of technology.

10. The Parties shall, in accordance with Article 10, take into consideration in the implementation of the commitments of the Convention the situation of Parties, particularly developing country Parties, with economies that are vulnerable to the adverse effects of the implementation of measures to respond to climate change. This applies notably to Parties with economies that are highly dependent on income generated from the production, processing and export, and/or consumption of fossil fuels and associated energy-intensive products and/or the use of fossil fuels for which such Parties have serious difficulties in switching to alternatives.

ARTICLE 5: RESEARCH AND SYSTEMATIC OBSERVATION

In carrying out their commitments under Article 4, paragraph 1(g), the Parties shall:

(a) Support and further develop, as appropriate, international and intergovernmental programmes and networks or organizations aimed at defining, conducting, assessing and financing research, data collection and systematic observation, taking into account the need to minimize duplication of effort;

(b) Support international and intergovernmental efforts to strengthen systematic observation and national scientific and technical research capacities and capabilities, particularly in developing countries, and to promote access to, and the exchange of, data and analyses thereof obtained from areas beyond national jurisdiction; and

(c) Take into account the particular concerns and needs of developing countries and cooperate in improving their endogenous capacities and capabilities to participate in the efforts referred to in subparagraphs (a) and (b) above.

ARTICLE 6: EDUCATION, TRAINING AND PUBLIC AWARENESS

In carrying out their commitments under Article 4, paragraph 1(i), the Parties shall:

(a) Promote and facilitate at the national and, as appropriate, subregional and regional levels, and in accordance with national laws and regulations, and within their respective capacities:

  (i) The development and implementation of educational and public awareness programmes on climate change and its effects;

  (ii) Public access to information on climate change and its effects;

  (iii) Public participation in addressing climate change and its effects and developing adequate responses; and

  (iv) Training of scientific, technical and managerial personnel.

(b) Cooperate in and promote, at the international level, and, where appropriate, using existing bodies:

  (i) The development and exchange of educational and public awareness material on climate change and its effects; and

  (ii) The development and implementation of education and training programmes, including the strengthening of national institutions and the exchange or secondment of personnel to train experts in this field, in particular for developing countries.

ARTICLE 7: CONFERENCE OF THE PARTIES

1. A Conference of the Parties is hereby established.

2. The Conference of the Parties, as the supreme body of this Convention, shall keep under regular review the implementation of the Convention and any related legal instruments that the

Conference of the Parties may adopt, and shall make, within its mandate, the decisions necessary to promote the effective implementation of the Convention. To this end, it shall:

(a) Periodically examine the obligations of the Parties and the institutional arrangements under the Convention, in the light of the objective of the Convention, the experience gained in its implementation and the evolution of scientific and technological knowledge;

(b) Promote and facilitate the exchange of information on measures adopted by the Parties to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under the Convention;

(c) Facilitate, at the request of two or more Parties, the coordination of measures adopted by them to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under the Convention;

(d) Promote and guide, in accordance with the objective and provisions of the Convention, the development and periodic refinement of comparable methodologies, to be agreed on by the Conference of the Parties, inter alia, for preparing inventories of greenhouse gas emissions by sources and removals by sinks, and for evaluating the effectiveness of measures to limit the emissions and enhance the removals of these gases;

(e) Assess, on the basis of all information made available to it in accordance with the provisions of the Convention, the implementation of the Convention by the Parties, the overall effects of the measures taken pursuant to the Convention, in particular environmental, economic and social effects as well as their cumulative impacts and the extent to which progress towards the objective of the Convention is being achieved;

(f) Consider and adopt regular reports on the implementation of the Convention and ensure their publication;

(g) Make recommendations on any matters necessary for the implementation of the Convention;

(h) Seek to mobilize financial resources in accordance with Article 4, paragraphs 3, 4 and 5, and Article 11;

(i) Establish such subsidiary bodies as are deemed necessary for the implementation of the Convention;

(j) Review reports submitted by its subsidiary bodies and provide guidance to them;

(k) Agree upon and adopt, by consensus, rules of procedure and financial rules for itself and for any subsidiary bodies;

(l) Seek and utilize, where appropriate, the services and cooperation of, and information provided by, competent international organizations and intergovernmental and non-governmental bodies; and

(m) Exercise such other functions as are required for the achievement of the objective of the Convention as well as all other functions assigned to it under the Convention.

3. The Conference of the Parties shall, at its first session, adopt its own rules of procedure as well as those of the subsidiary bodies established by the Convention, which shall include decision-making procedures for matters not already covered by decision- making procedures stipulated in the Convention. Such procedures may include specified majorities required for the adoption of particular decisions.

4. The first session of the Conference of the Parties shall be convened by the interim secretariat referred to in Article 21 and shall take place not later than one year after the date of entry into force of the Convention. Thereafter, ordinary sessions of the Conference of the Parties shall be held every year unless otherwise decided by the Conference of the Parties.

5. Extraordinary sessions of the Conference of the Parties shall be held at such other times as may be deemed necessary by the Conference, or at the written request of any Party, provided that, within six months of the request being communicated to the Parties by the secretariat, it is supported by at least one third of the Parties.

6. The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State member thereof or observers thereto not Party to the Convention, may be represented at sessions of the Conference of the Parties as observers. Any body or agency, whether national or international, governmental or non- governmental, which is qualified in matters covered by the Convention, and which has informed the secretariat of its wish to be represented at a session of the Conference of the Parties as an observer, may be so admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure adopted by the Conference of the Parties.

ARTICLE 8: SECRETARIAT

1. A secretariat is hereby established.

2. The functions of the secretariat shall be:

(a) To make arrangements for sessions of the Conference of the Parties and its subsidiary bodies established under the Convention and to provide them with services as required;

(b) To compile and transmit reports submitted to it;

(c) To facilitate assistance to the Parties, particularly developing country Parties, on request, in the compilation and communication of information required in accordance with the provisions of the Convention;

(d) To prepare reports on its activities and present them to the Conference of the Parties;

(e) To ensure the necessary coordination with the secretariats of other relevant international bodies;

(f) To enter, under the overall guidance of the Conference of the Parties, into such administrative and contractual arrangements as may be required for the effective discharge of its functions; and

(g) To perform the other secretariat functions specified in the Convention and in any of its protocols and such other functions as may be determined by the Conference of the Parties.

3. The Conference of the Parties, at its first session, shall designate a permanent secretariat and make arrangements for its functioning.

ARTICLE 9: SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE

1. A subsidiary body for scientific and technological advice is hereby established to provide the Conference of the Parties and, as appropriate, its other subsidiary bodies with timely information and advice on scientific and technological matters relating to the Convention. This body shall be open to participation by all Parties and shall be multidisciplinary. It shall comprise government representatives competent in the relevant field of expertise. It shall report regularly to the Conference of the Parties on all aspects of its work.

2. Under the guidance of the Conference of the Parties, and drawing upon existing competent international bodies, this body shall:

(a) Provide assessments of the state of scientific knowledge relating to climate change and its effects;

(b) Prepare scientific assessments on the effects of measures taken in the implementation of the Convention;

(c) Identify innovative, efficient and state-of-the-art technologies and know-how and advise on the ways and means of promoting development and/or transferring such technologies;

(d) Provide advice on scientific programmes, international cooperation in research and development related to climate change, as well as on ways and means of supporting endogenous capacity-building in developing countries; and

(e) Respond to scientific, technological and methodological questions that the Conference of the Parties and its subsidiary bodies may put to the body.

3. The functions and terms of reference of this body may be further elaborated by the Conference of the Parties.

ARTICLE 10: SUBSIDIARY BODY FOR IMPLEMENTATION

1. A subsidiary body for implementation is hereby established to assist the Conference of the Parties in the assessment and review of the effective implementation of the Convention. This body shall be open to participation by all Parties and comprise government representatives who are experts on matters related to climate change. It shall report regularly to the Conference of the Parties on all aspects of its work.

2. Under the guidance of the Conference of the Parties, this body shall:

(a) Consider the information communicated in accordance with Article 12, paragraph 1, to assess the overall aggregated effect of the steps taken by the Parties in the light of the latest scientific assessments concerning climate change;

(b) Consider the information communicated in accordance with Article 12, paragraph 2, in order to assist the Conference of the Parties in carrying out the reviews required by Article 4, paragraph 2(d); and

(c) Assist the Conference of the Parties, as appropriate, in the preparation and implementation of its decisions.

ARTICLE 11: FINANCIAL MECHANISM

1. A mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology, is hereby defined. It shall function under the guidance of and be accountable to the Conference of the Parties, which shall decide on its policies, programme priorities and eligibility criteria related to this Convention. Its operation shall be entrusted to one or more existing international entities.

2. The financial mechanism shall have an equitable and balanced representation of all Parties within a transparent system of governance.

3. The Conference of the Parties and the entity or entities entrusted with the operation of the financial mechanism shall agree upon arrangements to give effect to the above paragraphs, which shall include the following:

(a) Modalities to ensure that the funded projects to address climate change are in conformity with the policies, programme priorities and eligibility criteria established by the Conference of the Parties;

(b) Modalities by which a particular funding decision may be reconsidered in light of these policies, programme priorities and eligibility criteria;

(c) Provision by the entity or entities of regular reports to the Conference of the Parties on its funding operations, which is consistent with the requirement for accountability set out in paragraph 1 above; and

(d) Determination in a predictable and identifiable manner of the amount of funding necessary and available for the implementation of this Convention and the conditions under which that amount shall be periodically reviewed.

4. The Conference of the Parties shall make arrangements to implement the above-mentioned provisions at its first session, reviewing and taking into account the interim arrangements referred to in Article 21, paragraph 3, and shall decide whether these interim arrangements shall be maintained. Within four years thereafter, the Conference of the Parties shall review the financial mechanism and take appropriate measures.

5. The developed country Parties may also provide and developing country Parties avail themselves of, financial resources related to the implementation of the Convention through bilateral, regional and other multilateral channels.

ARTICLE 12: COMMUNICATION OF INFORMATION RELATED TO IMPLEMENTATION

1. In accordance with Article 4, paragraph 1, each Party shall communicate to the Conference of the Parties, through the secretariat, the following elements of information:

(a) A national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of the Parties;

(b) A general description of steps taken or envisaged by the Party to implement the Convention; and

(c) Any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including, if feasible, material relevant for calculations of global emission trends.

2. Each developed country Party and each other Party included in Annex I shall incorporate in its communication the following elements of information:

(a) A detailed description of the policies and measures that it has adopted to implement its commitment under Article 4, paragraphs 2(a) and 2(b); and

(b) A specific estimate of the effects that the policies and measures referred to in subparagraph (a) immediately above will have on anthropogenic emissions by its sources and removals by its sinks of greenhouse gases during the period referred to in Article 4, paragraph 2(a).

3. In addition, each developed country Party and each other developed Party included in Annex II shall incorporate details of measures taken in accordance with Article 4, paragraphs 3, 4 and 5.

4. Developing country Parties may, on a voluntary basis, propose projects for financing, including specific technologies, materials, equipment, techniques or practices that would be needed to implement such projects, along with, if possible, an estimate of all incremental costs, of the reductions of emissions and increments of removals of greenhouse gases, as well as an estimate of the consequent benefits.

5. Each developed country Party and each other Party included in Annex I shall make its initial communication within six months of the entry into force of the Convention for that Party. Each Party not so listed shall make its initial communication within three years of the entry into force of the Convention for that Party, or of the availability of financial resources in accordance with Article 4, paragraph 3. Parties that are least developed countries may make their initial communication at their discretion. The frequency of subsequent communications by all Parties shall be determined by the Conference of the Parties, taking into account the differentiated timetable set by this paragraph.

6. Information communicated by Parties under this Article shall be transmitted by the secretariat as soon as possible to the Conference of the Parties and to any subsidiary bodies concerned. If necessary, the procedures for the communication of information may be further considered by the Conference of the Parties.

7. From its first session, the Conference of the Parties shall arrange for the provision to developing country Parties of technical and financial support, on request, in compiling and communicating information under this Article, as well as in identifying the technical and financial needs associated with proposed projects and response measures under Article 4. Such support may be provided by other Parties, by competent international organizations and by the secretariat, as appropriate.

8. Any group of Parties may, subject to guidelines adopted by the Conference of the Parties, and to prior notification to the Conference of the Parties, make a joint communication in fulfilment of their obligations under this Article, provided that such a communication includes information on the fulfilment by each of these Parties of its individual obligations under the Convention.

9. Information received by the secretariat that is designated by a Party as confidential, in accordance with criteria to be established by the Conference of the Parties, shall be aggregated by the secretariat to protect its confidentiality before being made available to any of the bodies involved in the communication and review of information.

10. Subject to paragraph 9 above, and without prejudice to the ability of any Party to make public its communication at any time, the secretariat shall make communications by Parties under this Article publicly available at the time they are submitted to the Conference of the Parties.

ARTICLE 13: RESOLUTION OF QUESTIONS REGARDING IMPLEMENTATION

The Conference of the Parties shall, at its first session, consider the establishment of a multilateral consultative process, available to Parties on their request, for the resolution of questions regarding the implementation of the Convention.

ARTICLE 14: SETTLEMENT OF DISPUTES

1. In the event of a dispute between any two or more Parties concerning the interpretation or application of the Convention, the Parties concerned shall seek a settlement of the dispute through negotiation or any other peaceful means of their own choice.

2. When ratifying, accepting, approving or acceding to the Convention, or at any time thereafter, a Party which is not a regional economic integration organization may declare in a written instrument submitted to the Depositary that, in respect of any dispute concerning the interpretation or application of the Convention, it recognizes as compulsory ipso facto and without special agreement, in relation to any Party accepting the same obligation:

(a) Submission of the dispute to the International Court of Justice, and/or

(b) Arbitration in accordance with procedures to be adopted by the Conference of the Parties as soon as practicable, in an annex on arbitration.

A Party which is a regional economic integration organization may make a declaration with like effect in relation to arbitration in accordance with the procedures referred to in subparagraph (b) above.

3. A declaration made under paragraph 2 above shall remain in force until it expires in accordance with its terms or until three months after written notice of its revocation has been deposited with the Depositary.

4. A new declaration, a notice of revocation or the expiry of a declaration shall not in any way affect proceedings pending before the International Court of Justice or the arbitral tribunal, unless the parties to the dispute otherwise agree.

5. Subject to the operation of paragraph 2 above, if after twelve months following notification by one Party to another that a dispute exists between them, the Parties concerned have not been able to settle their dispute through the means mentioned in paragraph 1 above, the dispute shall be submitted, at the request of any of the parties to the dispute, to conciliation.

6. A conciliation commission shall be created upon the request of one of the parties to the dispute. The commission shall be composed of an equal number of members appointed by each party concerned and a chairman chosen jointly by the members appointed by each party. The commission shall render a recommendatory award, which the parties shall consider in good faith.

7. Additional procedures relating to conciliation shall be adopted by the Conference of the Parties, as soon as practicable, in an annex on conciliation.

8. The provisions of this Article shall apply to any related legal instrument which the Conference of the Parties may adopt, unless the instrument provides otherwise.

ARTICLE 15: AMENDMENTS TO THE CONVENTION

1. Any Party may propose amendments to the Convention.

2. Amendments to the Convention shall be adopted at an ordinary session of the Conference of the Parties. The text of any proposed amendment to the Convention shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate proposed amendments to the signatories to the Convention and, for information, to the Depositary.

3. The Parties shall make every effort to reach agreement on any proposed amendment to the Convention by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted amendment shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.

4. Instruments of acceptance in respect of an amendment shall be deposited with the Depositary. An amendment adopted in accordance with paragraph 3 above shall enter into force for those Parties having accepted it on the ninetieth day after the date of receipt by the Depositary of an instrument of acceptance by at least three fourths of the Parties to the Convention.

5. The amendment shall enter into force for any other Party on the ninetieth day after the date on which that Party deposits with the Depositary its instrument of acceptance of the said amendment.

6. For the purposes of this Article, "Parties present and voting" means Parties present and casting an affirmative or negative vote.

ARTICLE 16: ADOPTION AND AMENDMENT OF ANNEXES TO THE CONVENTION

1. Annexes to the Convention shall form an integral part thereof and, unless otherwise expressly provided, a reference to the Convention constitutes at the same time a reference to any annexes thereto. Without prejudice to the provisions of Article 14, paragraphs 2(b) and 7, such annexes

shall be restricted to lists, forms and any other material of a descriptive nature that is of a scientific, technical, procedural or administrative character.

2. Annexes to the Convention shall be proposed and adopted in accordance with the procedure set forth in Article 15, paragraphs 2, 3 and 4.

3. An annex that has been adopted in accordance with paragraph 2 above shall enter into force for all Parties to the Convention six months after the date of the communication by the Depositary to such Parties of the adoption of the annex, except for those Parties that have notified the Depositary, in writing, within that period of their non-acceptance of the annex. The annex shall enter into force for Parties which withdraw their notification of non-acceptance on the ninetieth day after the date on which withdrawal of such notification has been received by the Depositary.

4. The proposal, adoption and entry into force of amendments to annexes to the Convention shall be subject to the same procedure as that for the proposal, adoption and entry into force of annexes to the Convention in accordance with paragraphs 2 and 3 above.

5. If the adoption of an annex or an amendment to an annex involves an amendment to the Convention, that annex or amendment to an annex shall not enter into force until such time as the amendment to the Convention enters into force.

ARTICLE 17: PROTOCOLS

1. The Conference of the Parties may, at any ordinary session, adopt protocols to the Convention.

2. The text of any proposed protocol shall be communicated to the Parties by the secretariat at least six months before such a session.

3. The requirements for the entry into force of any protocol shall be established by that instrument.

4. Only Parties to the Convention may be Parties to a protocol.

5. Decisions under any protocol shall be taken only by the Parties to the protocol concerned.

ARTICLE 18: RIGHT TO VOTE

1. Each Party to the Convention shall have one vote, except as provided for in paragraph 2 below.

2. Regional economic integration organizations, in matters within their competence, shall exercise their right to vote with a number of votes equal to the number of their member States that are Parties to the Convention. Such an organization shall not exercise its right to vote if any of its member States exercises its right, and vice versa.

ARTICLE 19: DEPOSITARY

The Secretary-General of the United Nations shall be the Depositary of the Convention and of protocols adopted in accordance with Article 17.

ARTICLE 20: SIGNATURE

This Convention shall be open for signature by States Members of the United Nations or of any of its specialized agencies or that are Parties to the Statute of the International Court of Justice and by regional economic integration organizations at Rio de Janeiro, during the United Nations Conference on Environment and Development, and thereafter at United Nations Headquarters in New York from 20 June 1992 to 19 June 1993.

ARTICLE 21: INTERIM ARRANGEMENTS

1. The secretariat functions referred to in Article 8 will be carried out on an interim basis by the secretariat established by the General Assembly of the United Nations in its resolution 45/212 of 21 December 1990, until the completion of the first session of the Conference of the Parties.

2. The head of the interim secretariat referred to in paragraph 1 above will cooperate closely with the Intergovernmental Panel on Climate Change to ensure that the Panel can respond to the need for objective scientific and technical advice. Other relevant scientific bodies could also be consulted.

3. The Global Environment Facility of the United Nations Development Programme, the United Nations Environment Programme and the International Bank for Reconstruction and Development shall be the international entity entrusted with the operation of the financial mechanism referred to in Article 11 on an interim basis. In this connection, the Global Environment Facility should be appropriately restructured and its membership made universal to enable it to fulfil the requirements of Article 11.

ARTICLE 22: RATIFICATION, ACCEPTANCE, APPROVAL OR ACCESSION

1. The Convention shall be subject to ratification, acceptance, approval or accession by States and by regional economic integration organizations. It shall be open for accession from the day after the date on which the Convention is closed for signature. Instruments of ratification, acceptance, approval or accession shall be deposited with the Depositary.

2. Any regional economic integration organization which becomes a Party to the Convention without any of its member States being a Party shall be bound by all the obligations under the Convention. In the case of such organizations, one or more of whose member States is a Party to the Convention, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under the Convention. In such cases, the

organization and the member States shall not be entitled to exercise rights under the Convention concurrently.

3. In their instruments of ratification, acceptance, approval or accession, regional economic integration organizations shall declare the extent of their competence with respect to the matters governed by the Convention. These organizations shall also inform the Depositary, who shall in turn inform the Parties, of any substantial modification in the extent of their competence.

ARTICLE 23: ENTRY INTO FORCE

1. The Convention shall enter into force on the ninetieth day after the date of deposit of the fiftieth instrument of ratification, acceptance, approval or accession.

2. For each State or regional economic integration organization that ratifies, accepts or approves the Convention or accedes thereto after the deposit of the fiftieth instrument of ratification, acceptance, approval or accession, the Convention shall enter into force on the ninetieth day after the date of deposit by such State or regional economic integration organization of its instrument of ratification, acceptance, approval or accession.

3. For the purposes of paragraphs 1 and 2 above, any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by States members of the organization.

ARTICLE 24: RESERVATIONS

No reservations may be made to the Convention.

ARTICLE 25: WITHDRAWAL

1. At any time after three years from the date on which the Convention has entered into force for a Party, that Party may withdraw from the Convention by giving written notification to the Depositary.

2. Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depositary of the notification of withdrawal, or on such later date as may bespecified in the notification of withdrawal.

3. Any Party that withdraws from the Convention shall be considered as also having withdrawn from any protocol to which it is a Party.

ARTICLE 26: AUTHENTIC TEXTS

The original of this Convention, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary- General of the United Nations.

IN WITNESS WHEREOF the undersigned, being duly authorized to that effect, have signed this Convention.

DONE at New York this ninth day of May one thousand nine hundred and ninety-two.

ANNEX I

Australia
Austria
Belarus[a/]
Belgium
Bulgaria[a/]
Canada
Crotia[a/]
Czech Republic[a/]
Denmark
European Economic Community
Estonia[a/]
Finland
France
Germany
Greece
Hungary[a/]
Iceland
Ireland
Italy
Japan
Latvia[a/]
Liechtenstein
Lithuania[a/]
Luxembourg
Monaco
Netherlands
New Zealand
Norway
Poland[a/]
Portugal
Romania[a/]
Russian Federation[a/]
Slovakia[a/]
Slovenia[a/]
Spain
Sweden
Switzerland
Turkey
Ukraine[a/]
United Kingdom of Great Britain and Northern Ireland
United States of America

[a/] Countries that are undergoing the process of transition to a market economy.

Annex II

Australia
Austria
Belgium
Canada
Denmark
European Economic Community
Finland
France
Germany
Greece
Iceland
Ireland
Italy
Japan
Luxembourg
Netherlands
New Zealand
Norway
Portugal
Spain
Sweden
Switzerland
Turkey
United Kingdom of Great Britain and Northern Ireland
United States of America

Administration Remarks/Speeches

TESTIMONY OF DR. JANET YELLEN
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Thank you, Mr. Chairman. The President has said that we can work to avert the grave dangers of climate change, while at the same time maintaining the strength of our economy. I agree and am pleased to have this opportunity to appear before the Committee to elaborate on the Administration's views on these issues.

The international agreement that was reached in Kyoto this past December is a crucial step forward in addressing global climate change. But it is only one step in a journey. Since the international effort to reduce greenhouse gas emissions is still in some respects a work-in- progress, it is not yet possible to provide a full authoritative analysis of it. Many of the specifics in several crucial areas are not completely resolved in the diplomatic arena, forcing analysts to make a variety of assumptions about the ultimate form of the international regime. In my testimony today, I will attempt to identify key elements of the agreement and the Administration's policy, such as international emissions trading, meaningful developing country participation, inclusion of land-use activities that absorb carbon ("sinks") and six categories of gases, as well as domestic initiatives, that together can ensure that reductions in global greenhouse gas emissions are consistent with continued strong economic growth. I will explain the reasoning underlying our conclusion that, under these conditions, economic impacts are likely to be modest.

The Administration is strongly committed to ensuring that these key elements are reflected in our domestic and international climate change policies. We are firmly committed to meaningful developing country participation, the use of sinks to offset emissions requirements, and emissions trading both domestically and internationally. And as you know, the President's FY 1999 budget includes a $6.3 billion package of tax cuts and R&D investments over the next 5 years; this package makes good sense in terms of energy policy and will jumpstart our efforts. A final component of the President's climate change policy is his support for electricity restructuring in a manner that will offer approximately $20 billion in cost savings to electricity consumers, while reducing greenhouse gas emissions.

I. Basic Economic Rationale of the Kyoto Treaty

To begin our analysis, it may be worth stepping back and examining the larger question of the basic rationale, from an economist's perspective, for the Kyoto Protocol.

The earth's surface appears to be warming from the accumulation of greenhouse gases from myriad sources worldwide. None of these emitters presently pays the cost to others of warming's adverse effects — a classic externality in the language of economists. As a result of these distorted incentives, disruption of the Earth's climate is likely to proceed at an excessive pace and if left uncontrolled may pose substantial costs in terms of harm to commerce and the environment alike. The fundamental economic logic of the Kyoto Protocol is thus that without such an international agreement, individual nations will not have the proper incentives to address the threats from global climate change.

II. Costs of Climate Change

In evaluating efforts to mitigate global warming, the first step is to consider the costs of inaction. These costs — and they are significant — provide the primary motivation for actions to reduce greenhouse gas emissions.

The Intergovernmental Panel on Climate Change (IPCC) jointly established by the World Meteorological Organization and the United Nations Environment Programme, concluded in 1995 that "the balance of evidence suggests that there is a discernible human influence on global climate." Current concentrations of carbon dioxide, methane, nitrous oxide, and the other so-called greenhouse gases have reached levels well above those of preindustrial times. Of these, carbon dioxide (CO_2) is the most important: net cumulative CO_2 emissions resulting from the burning of fossil fuels and deforestation account for about two-thirds of potential warming from changes in greenhouse gas concentrations related to human activity.

Climatic Impact

If growth in global emissions continues unabated, the atmospheric concentration of CO_2 will likely double relative to its preindustrial level by midway through the next century and continue to rise thereafter. As a result of the increased concentration of CO_2, the IPCC estimates that global temperatures will increase by between 2 to 6 degrees Fahrenheit in the next 100 years, with a best guess of about 3.5 degrees Fahrenheit. While scientists believe that human activities are leading to a gradual warming of the average temperature of the earth, the change in temperature in a given region at a given time may differ substantially from this average. Indeed, models predict warming will be greater in high latitudes than in the tropics, and greater over land than ocean.

Potential consequences associated with this shift in climate include a rise in sea levels, greater frequency of severe weather events, shifts in agricultural growing conditions from changing weather patterns, threats to human health from increased range and incidence of diseases, changes in availability of freshwater supplies, and damage to ecosystems and biodiversity.

Economic and Monetary Damages

The derivation of quantitative or monetary estimates of the damages from such a change in the climate is extremely difficult given the capacity of today's models. Estimates of the economic damages from climate change fall into the following broad areas: agriculture, sea-level rise, air conditioning and heating, water supply, human life and health, air pollution, and other costs (hurricanes, relocation costs, human amenity, construction, leisure activities, urban infrastructure, and ecological damages such as forest loss and species loss). Although the quantification of these effects is quite demanding, researchers have developed estimates that prompt substantial concern. The IPCC reports that a doubling of carbon dioxide levels would lead to approximately 10,000 estimated additional deaths per year for the current U.S. population from higher summer temperatures, even after netting out the effects of warmer winters and assuming acclimatization. Other researchers have predicted sea level increases of about 20 inches by 2100, with greater increases in subsequent years.

Despite the difficulties, respected researchers have developed estimates of the monetary damages expected from an average worldwide temperature increase. For example, William Cline, then of the Institute for International Economics, estimated that a temperature change of 4.5 degrees Fahrenheit would impose annual damages of about 1.1 percent of GDP per year on the U.S. economy. That amounts to $89 billion in today's terms. (Cline's original estimate is quoted in 1990 dollars. The figure given above translates this number into 1997 terms by scaling it to current GDP.) William Nordhaus of Yale University has likewise computed estimates of the dollar loss attributable to a doubling of greenhouse gas concentrations. Although he uses methods that differ from Cline's in several respects, Nordhuas estimates that a slightly larger temperature change of 5.4 degrees Fahrenheit would impose losses equal to about 1 percent of GDP. A third independent estimate reported by Nordhaus is close to Cline's. It must be noted, however, that this similarity among aggregated estimates masks the true uncertainty associated with forecasts of the damages from given increases in global warming — the estimates are all fundamentally based on extrapolations from current and past experience, and may not fully incorporate effects that will unfortunately become apparent only with future experience.

One key difficulty in interpreting and monetizing these estimates of damages is uncertainty over the extent that they should be discounted because they occur in the distant future. Since the benefits of stemming future climate change accrue over not only decades but centuries, small changes in the discount rate can produce substantial changes in the results. But the precise discount rate that should be used to evaluate questions as important as the future climate of the planet remains a subject of intense debate. It is safe to say that there is, as yet, no professional consensus on the issue. Indeed there can be no technical answer to the ethical question how we should value the welfare of future generations.

A similar difficulty with such estimates is that they do not include potential non-linearities in the relationships between greenhouse gas concentrations and temperature, between temperature and economic damages, or in the various other complicated relationships governing interactions between greenhouse gas emissions, the climate, and the economy. Current estimates of damages do not, and cannot, accurately reflect the value of reducing the unknown risk of large-scale and potentially irreversible discrete events with potentially catastrophic consequences.

Two such possibilities serve as illustrations. Warming of Northern tundra may release huge amounts of methane from the permafrost, thereby leading to accelerated warming. We do not know at what point, if any, such potentially unstable activity would be triggered. Second, evidence from climate models suggests that some types of climate change may lead to changes in ocean currents, including weakening of the Gulf Stream that warms Western Europe. Scientific evidence suggests that abrupt seawater temperature shifts have occurred over periods as short as decades.

To what extent are we willing to take such chances with our planet? There is a strong argument for the Kyoto Protocol as a form of planet insurance. But what numerical weight should one assign to these catastrophic risks? In other words, what is the value of the insurance policy? Although it is difficult for an economist, or anyone, to know, reductions in the risk of such catastrophic outcomes must be considered in addition to the costs and benefits that can be reasonably quantified. Since human beings are typically averse to risk, such catastrophic risks are especially important in evaluating whether the benefits of a particular climate control policy justify the costs. One must have at least some sympathy with those who criticize economists on the grounds that the effects of climate change are extremely difficult to quantify in a single monetary number.

III. Addressing Global Climate Change in an Efficient Manner

The costs of unabated climate change may thus be difficult to quantify, but they are nonetheless real and provide the motivation for reducing greenhouse gas emissions. In taking action to reduce those emissions, economic analysis suggests that two elements are absolutely essential:

- The effort must be global, to address the global externality inherent in the nature of the problem.

- The effort must be flexible and market-based, to ensure that we achieve our objectives in the most efficient manner possible.

Need for Global Action

Climate change is a global problem requiring a global solution. As I mentioned earlier, no single country has an incentive to reduce emissions sufficiently to protect the global environment against climate change. Each has an economic incentive to "free ride" on the efforts of others. Even if the United States sharply reduced its emissions unilaterally without an international agreement limiting emissions abroad, greenhouse gas emissions from all other countries would continue to grow, and the risks posed by climate change would not be significantly reduced. It is important to emphasize that emissions of different gases anyplace in the world have very similar effects on global climate.

The threat of disruptive climate change has led to coordinated international efforts to reduce the risks of global warming by reducing emissions of greenhouse gases. A landmark international agreement to address global warming was the Framework Convention on Climate Change signed during the Earth Summit in Rio de Janeiro in 1992. This convention established an objective of limiting greenhouse gas concentrations and called upon industrial countries to return their emissions to 1990 levels by 2000. Since then, it has become clear that the United States and many other participating countries will not meet this voluntary goal; quite the contrary, emission levels have continued to rise not fall among both developed and developing countries.

To address the lack of progress among many industrialized countries toward meeting the Rio objective, the United States and approximately 160 other nations agreed in negotiations held in Kyoto, Japan, last December, to reduce emissions of greenhouse gases. The Kyoto Protocol, which requires the advice and consent of the Senate, would place binding limits on each industrial country's combined emissions of the six principal categories of greenhouse gases: carbon dioxide (CO_2), nitrous oxide (N_2O), methane, sulfur hexafluoride, perfluorocarbons, and hydrofluorocarbons. These limits apply to the 38 so-called Annex I countries, which are the industrialized countries, defined to include Russia, Ukraine, and most Eastern European countries.

Under the Kyoto Protocol, each industrial country's baseline is its 1990 emissions of CO_2, methane, and N_2O and its choice of 1990 or 1995 levels of the other three categories of gases. The United States agreed to a target of 7 percent below this baseline by the period between 2008 and 2012. Given the changes in the definition of the baseline for the three long-lived chemical compounds (HFCs, PFCs and SF_6) from 1990 to 1995 combined with a change in the way sinks are accounted for in the baseline, the actual reduction required in the U.S. is no more than 2-3% more than the President originally proposed as the U.S. negotiating position. The targets for the European Union and Japan are 8 percent and 6 percent below 1990 levels, respectively. Australia, New Zealand, Norway, Russia, and Ukraine all have limits somewhat less ambitious when phrased as cuts relative to their 1990 levels. In sum, over the period from 2008 to 2012, the industrial countries are expected to reduce their average emissions of greenhouse gases to about 5 percent below their 1990 levels. The President has made clear that he will not submit the Kyoto Protocol to the Senate without meaningful participation from key developing countries (who are not included in Annex I).

There are several reasons why meaningful participation from developing countries is essential. First, developing countries are projected to contribute a majority of world emissions around 2030 under a continuation of business-as-usual. Without the participation of developing economies, efforts by the industrialized countries to limit emissions will therefore not provide adequate protection from climate change.

Second, developing country participation is crucial because it would permit relatively low-cost emissions reductions to be internationally recognized as a substitute for more expensive emissions reductions that might otherwise be achieved domestically by U.S. companies and those in other industrialized countries. Since greenhouse gas emissions have the same basic impact on the climate regardless of where they occur, emission reductions in developing countries have the same environmental benefit as reductions in the U.S. But these reductions are much less costly than reductions in the U.S. or in other developed nations, because of the very inefficient and carbon-intensive uses of energy in these countries today. It thus makes sense, from both an environmental and an economic perspective, to incorporate emissions reductions in developing countries into the international system.

Third, principles of basic fairness suggest all countries should do their part, depending, in part, on their ability to contribute to the solution. Thus even poor countries should participate, although the lack of resources in such countries may limit the extent of their participation.

Some have expressed fears that the Kyoto Protocol might adversely affect the competitive position of American industry. Evaluating how the Kyoto Protocol could affect competitiveness of a few specific manufacturing industries — especially those that are especially energy-intensive, such as aluminum and chemicals — is complex. The answer depends, in part, on the impact of the agreement on energy prices, which we will shortly address. In general it is difficult to undergo a structural change in the economy without having the effect of expanding some sectors and contracting others. But to provide some perspective on this issue, consider the following facts. First, on average, energy constitutes only 2.2 percent of total costs to U.S. industry. Second, energy prices already vary significantly across countries. According to the *1997 Statistical Abstract*, for example, in 1996 premium gasoline cost $1.28 per gallon in the United States — but only 8 cents per gallon in Venezuela. Similarly, gas prices were $3.71 per gallon in Switzerland and $4.41 per gallon in France. Electricity prices also vary significantly: in the U.S., for industry, they were 5 cents per kilowatt hour in 1995, a fraction of prices in Switzerland of 13 cents per kilowatt hour. Yet U.S. industry is not moving en masse to Venezuela, nor is Swiss industry moving to the United States. Third, roughly two-thirds of all emissions are not in manufacturing at all, but in transportation and buildings, sectors which, by their very nature, are severely limited in their ability to relocate to other countries. We therefore believe we need developing country participation because the problem is global and cost- effective solutions are essential, than to avoid adverse effects on competitiveness.

Flexibility and Market Mechanisms

A global solution is thus critical to the global problem of climate change. Globalizing the solution is not, however, enough by itself. We must also ensure that our reductions in global greenhouse gas emissions are attained in the most efficient manner possible. The nature of the climate change problem suggests three basic methods to lower costs of achieving given levels of environmental protection. They can be characterized in terms of three categories of flexibility: (1) “when” flexibility; (2) “what” flexibility; and (3) “where” flexibility, which may be the most important of all. Such methods have long been championed by economists interested in increasing the efficiency of protection. Indeed, over 2,500 economists from academia, industry, and government alike urged such approaches in a letter they signed last year advocating action on climate change:

> "Economic studies have found that there are many potential policies to reduce greenhouse gas emissions for which the total benefits outweigh the total costs...The most efficient approach to slowing climate change is through market-based policies."

1. "When flexibility" (timing)

First is "when flexibility" or timing. Since climate change is a long-term problem, the exact timing of emissions reductions is, within some range, not of primary importance. Thus the freedom to delay or accelerate reductions within an agreed upon time frame — while ensuring credibility of emissions reductions — lowers costs.

As a result of U.S. leadership, the Kyoto Protocol incorporates this principle of "when flexibility" in four ways:

- First, the initial emissions reductions are less severe, and the period over which they occur ends much later than what had been proposed by many other countries. By adopting a gradual and credible path of reductions in the early years, we can greatly reduce costs such as those from prematurely scrapping coal-fired electricity plants, while attaining the same ultimate environmental goals.

- Second, under the Kyoto Protocol, the emissions target is not specified in terms of a specific year, but rather in terms of an average over a five-year period (2008-2012). Averaging over five years, instead of requiring countries to meet a specific target each year, can lower costs, especially given an uncertain future. The averaging can smooth out the effects of short-term events such as fluctuations in the business cycle and energy demand, or hard winters and hot summers that would increase energy use and emissions.

- Third, there is allowance for "banking" emission reductions within the 2008-2012 commitment period, for use in a subsequent commitment period [although the emission targets of the subsequent periods have not yet been specified].

- Fourth, CDM credits achieved between 2000 and 2008 may be banked until 2008 to 2012.

2. "What flexibility" (gases and sinks)

The second type of flexibility is "what flexibility", along two dimensions. The first is the inclusion in the agreement of all six greenhouse gases. Emissions of different kinds of gases, not just carbon dioxide, contribute to the greenhouse effect. Since the IPCC has developed conversion factors for all greenhouse gases by estimating their global warming potentials, reductions in emissions of one gas can be used to substitute for increases in emissions of another by an amount that has equivalent environmental effects. Again at U.S. urging, all six gases are included, while Japan and the EU had insisted until the end on covering only three. Thus the U.S. succeeded in having the Kyoto Protocol stipulate that countries with binding targets are to reduce their *total* greenhouse gas emissions by certain percentages, but does not require specific reductions for specific gases. Since a molecule of sulfur hexafluoride is 23,900 times more potent over 100 years than a molecule of CO_2, it may be cheaper to achieve the same environmental benefit by eliminating one molecular unit of SF_6 than nearly 24,000 units of CO_2.

Some initial analysis indicates that a strategy of reducing non-CO_2 greenhouse gas emissions by a greater percent than CO_2 emissions could lower emissions permit prices by as much as 10 percent. Thus allowing countries flexibility in what gases they reduce — essentially trading emissions reductions across gases — can help lower significantly the costs of meeting their targets.

The second source of "what flexibility" is the treatment of sinks, i.e., land use activities that promote the removal of carbon from the atmosphere through the growth of plants. At the urging of the U.S. delegation, sinks can be used to offset emissions targets. Promoting such sinks through afforestation and reforestation may reduce atmospheric concentrations of CO_2 at much lower costs than reducing emissions of greenhouse gases.

3. "Where flexibility" (international)

The third type of flexibility, and perhaps the most important, is "where flexibility" (international). As I have already emphasized, emissions have the same environmental consequences regardless of where in the world they occur. Therefore, the least-cost approach to controlling climate change is to reduce emissions wherever such reductions are cheapest. The Kyoto Protocol, because of U.S. insistence and persistence, includes three important cost-saving provisions of this nature.

- First, it provides the opportunity for countries that take on binding targets to trade rights to emit greenhouse gases with each other. This market in emissions permits could ensure that emissions reductions occur where they are least expensive within the industrial countries. In particular, U.S. companies could purchase emissions reductions in other participating countries when doing so would reduce their costs — thus lowering costs without affecting the level of environmental protection. While currently only industrialized countries have emissions caps, this mechanism also offers an incentive for developing countries to take on emissions targets.

- Second, the agreement provides for Joint Implementation by Annex I countries. Thus if some countries do not develop programs to trade permits internationally, U.S. firms could nonetheless implement projects in those countries for which they could receive emissions reductions credits in the U.S.

- Third, the agreement allows industrial countries to invest in "clean development" projects in the developing world and use these projects' certified emissions reductions toward meeting their targets. Many such clean development projects may be quite cheap in terms of the cost per ton of emissions avoided, as has been illustrated by the Joint Implementation pilot program that is already in place in the U.S.

Details of how these provisions will operate will be discussed in future negotiations such as the one in Buenos Aires later this year. Nonetheless, effective international trading of emission credits, Joint Implementation, and the Clean Development Mechanism can lead to substantial reductions in costs relative to alternative policies that do not exploit the power of market incentives. To illustrate briefly the ability of U.S. industry to perform beyond expectations when given appropriate economic incentives, consider further EPA's highly acclaimed sulfur dioxide (SO_2) program, which relies, among other things, on a system of tradeable permits to reduce emissions of SO_2 from electric utilities. The SO_2 program has been successful in several ways: a large number of utilities participate, SO_2 emissions and ambient concentrations have fallen and the costs of reducing emissions are considerably lower than originally forecast.

As has been frequently noted, the average cost of SO_2 emissions reductions has recently been significantly lower than was originally forecast, in part due to the role of incentives in fostering innovation. Emission permit prices, currently at approximately $100 per ton of SO_2, are well below earlier estimates of around $250 to $400 per ton.

Trading programs may not always bring cost savings as large as those achieved by the SO_2 program; trading programs will not always be accompanied by the discovery of much cheaper control strategies. However, the SO_2 experience demonstrates clearly how programs like international permit trading, Joint Implementation, and the Clean Development Mechanism will lead firms to find cheaper ways of reducing emissions that can lead to unexpectedly low costs.

IV. Difficulties of Economic Analysis of the Kyoto Protocol

Now that we have a Protocol — even if it is not yet fully complete nor ready for the President's submission to the Senate — it is possible to examine it in somewhat more detail from an economic perspective. But, once again the inherent limitations of any such estimates deserve emphasis. Such limitations should not be surprising to you: economists have a difficult enough time projecting the behavior of the economy over the next quarter or year, let alone over the next two decades. The scale of the forecasting exercise is therefore daunting, and any specific results should be treated with substantial caution.

The difficulties associated with economic analysis of climate change fall into three broad categories. First are the uncertainties that still remain over the terms of the ultimate treaty, necessitating assumptions on which the analysis is predicated. Second are the inherent limitations of available models to analyze even short-term costs and benefits. And finally is a topic discussed earlier: the impossibility of putting a single monetary number on the long-term benefits of climate change mitigation, although there will clearly be economic benefits of emission reductions.

Uncertainties in the International Effort to Combat Climate Change

The Kyoto Protocol was an historic accomplishment, delineating the broad terms of the international effort to address climate change. But although we know a lot more than we did before Kyoto about how that international system can work, and that informs our analysis, there is still much that we do not know.

First, some provisions raise complex implementation issues. At issue here is the treatment of so-called sinks — activities that affect the rate at which carbon is removed from the atmosphere and "sequestered," e.g., by the planting of trees.

Second, the details of a number of items — primarily concerning international trading, the Clean Development Mechanism, and developing countries — are the subject of further discussions including future negotiations in Buenos Aires next fall, because they had not been definitively settled by the end of the Kyoto talks.

Finally, and most importantly, we have not yet negotiated international agreements to limit emissions beyond the 2012 window. The emission cuts agreed upon at Kyoto are only a first step on a long journey. The first step that we propose to take over the next 15 years is critical. But the reason it is critical is *not* that, by itself, it will solve the climate change problem — emissions during any given decade are small compared to the cumulative concentrations in the atmosphere. Rather, the first step is critical because we can not take the second and third steps until we have taken the first. At the same time, any analysis is complicated by the lack of knowledge over what the subsequent steps will be.

Inherent Limitations of Models

In addition to these uncertainties about the details of the international effort to address climate change, are the inherent limitations of the models used to evaluate that effort. Even within a given model, answers depend critically on the precise nature of the question asked. For example, the costs of emissions reductions depend critically on the extent of global participation and international trading that a treaty is assumed to feature. But in addition to the dependence of the results from a given model on the precise assumptions, different models can give different answers even when all the assumptions are specified to be the same — a concrete illustration of the range of uncertainty to which we must assign the predictions of any one individual model.

One area in which the uncertainty is particularly large is the pace of technological progress —especially the diffusion of existing energy-efficient technologies, but also the development of new technologies — and the extent to which the pace will accelerate in response to government programs. Models and experts on climate change policy tend to have a wider range of disagreement on the scope for speeding the diffusion of existing energy-efficient technologies than on any other single issue.

Furthermore, each model has strengths and weaknesses; each has questions to which it is better or worse suited to answer. Some, for example, model the energy sector in detail. Some allow for the fact that a coal-fired power plant cannot costlessly be converted to one that runs on natural gas. Some show the effects of hypothetical tax cuts made possible by the new revenues earned through the auction of emissions permits. Some are capable of showing recessions and booms. Others include a long-term "carbon cycle" model that can keep track of the accumulation of greenhouse gas concentrations in the atmosphere and their climatological effects. Some break down the rest of the world into regions and so can model international trade. No one model does everything, and therefore we must not rely blindly on the results of any one model or set of models. Professional judgement and economic intuition, along with diplomatic assessments, are also crucial.

Benefits of Averting Climate Change

As discussed above, it is evident that the benefits of averting climate change are potentially immense. But we have chosen not to try to quantify them in monetary terms, in light of the difficulties we have enumerated. These include the uncertainty of these benefits, their timing and therefore the extreme sensitivity of the results to the chosen discount rate, and the dependence of benefits on emissions paths after the 2008 to 2012 budget period specified in Kyoto.

V. Assessing the Kyoto Protocol

In order to evaluate the likely net economic impact of the Kyoto Protocol, *excluding the benefits of mitigating climate change itself*, we have drawn upon a variety of tools to assess the various possible costs and non-climate benefits of the Administration's emissions reduction policy. To give away the punch line, our conclusion is as follows: the net costs of our policies to reduce emissions are likely to be small, assuming those reductions are undertaken in an efficient manner and we are successful in securing meaningful developing country participation as well as effective international trading, and the Clean Development Mechanism in future negotiations. That potential small net premium, even excluding the benefits of mitigating climate change, in effect, purchases a partial insurance policy against a serious environmental threat.

Because the results from any model must be treated with caution, the Administration has employed a broad set of economic tools to assess the Kyoto Protocol. We have drawn on the insights of a wide range of models of the energy sector and economy over the next 25 years, including but not limited to the results of the Stanford Energy Modeling Forum exercises, the IPCC's review of the economic and social dimensions of climate change, the work of the OECD on Economic Dimensions and Policy Responses to Global Warming, and the staff-level Interagency Analytical Team analysis produced last year. Other tools include simple relevant statistics, "meta-analyses" such as work by the World Resources Institute, models, and basic economic reasoning. Drawing on this broad array of analytical tools is crucial to an intelligent evaluation of the policy alternatives.

To our knowledge, no model — whether used inside the government or not — has yet been set up to analyze the implications of the Kyoto Protocol, since this agreement is only a few months old and remains unfinished. In particular, no model is currently designed to assess Kyoto's treatment of sinks, or all six greenhouse gases. Some model-builders outside the government tend to take as long as several years to incorporate changes in policy parameters into their models.

Our thinking has been informed, however, by simulations conducted with the Second Generation Model of Battelle Laboratories, one of the leading models in the field. The SGM is one of the models best positioned to analyze the role of international trade in emission permits, which we consider to be a critical element of the Kyoto Treaty. However, the SGM does not cover all six gases included in the Kyoto Protocol or include a role for sinks. We have used the SGM model as one input into our overall assessment of the Kyoto treaty, but have attempted to supplement its results with additional analysis to account for such special features of the agreement as the inclusion of six gases, a possible trading arrangement that could include a subset of the Annex I countries and the Clean Development Mechanism. We will share with you today some preliminary results of this analysis. To the extent possible, we have compared results obtained with the SGM model with those of other modelling efforts..

Mindful of the limitations of any single model, we are eager to see features of the Kyoto Protocol assessed by other models to obtain a better feel for the range of possible effects. This work is just beginning and much of it will continue to go on outside the government. For example, the Energy Modeling Forum, based at Stanford University, is a long-running model comparison exercise involving many of the leading climate models. EMF is currently studying how features of the Kyoto legal language can be translated into terms recognizable to economic modelers. We expect that the group will conduct a full scale analysis of the Kyoto Protocol. The Energy Modeling Forum believes that its members will need at least until mid-year to update their results.

VI. Assessing the Potential Costs of Emissions Reductions

I said in Congressional testimony last July that we can do this smart or we can do this dumb. I was referring to the point that the costs of cutting emissions can be much reduced if flexible, market-based mechanisms are used. Our economic analysis highlighted the importance of such flexible, market-based mechanisms — which are therefore reflected, at the President's insistence, in the Kyoto Protocol and our ongoing diplomatic strategy.

Within the Kyoto Protocol, this means an insistence on international trading, Joint Implementation, the Clean Development Mechanism, and, ultimately, on meaningful developing country participation. Domestically, this means that we implement any emissions reductions through a market-based system of tradeable emissions permits, which ensures that we achieve reductions wherever they are least expensive. But this also means taking serious and responsible steps in the short run to prepare us to meet our obligations in the longer term.

The first such step is the inclusion in this year's budget of an aggressive, $6.3 billion program of tax cuts and R&D investments — $1.3 billion more than the $5 billion package the President promised in his October 22 speech on this issue. The goal is both to stimulate the development of new energy-saving and carbon-saving technologies and to encourage the dissemination of those that exist already. The proposed package contains $3.6 billion over the next 5 years in tax cuts for energy efficient purchases and renewable energy, including tax credits of $3,000 to $4,000 for consumers who purchase highly fuel efficient vehicles, a 15 percent credit (up to $2,000) for purchases of rooftop solar equipment, a 20 percent credit (subject to a cap) for purchasing energy-efficient building equipment, a credit up to $2,000 for purchasing energy-efficient new homes, an extension of the wind and biomass tax credit, and a 10 percent investment credit for the purchase of combined heat and power systems. The package also contains $2.7 billion over the next 5 years in additional research and development investments — covering the four major carbon-emitting sectors of the economy (buildings, industry, transportation, and electricity), plus carbon removal and sequestration, Federal facilities, and cross-cutting analyses and research. One example of the R&D effort is the Partnership for a New Generation of Vehicles (PNGV). PNGV is a government-industry effort to develop attractive, affordable cars that meet all applicable safety and environmental standards and get up to three times the fuel efficiency of today's cars. In FY99, the combined proposal for PNGV is $277 million, up from $227 million appropriated in FY98. Similar government-industry efforts are proposed to develop more efficient diesel engines for both light trucks and heavy trucks.

A second responsible step entails industry-by-industry consultations to prepare emission reduction plans in key industrial sectors. The Administration will work in partnership with industry to identify ways in which the Federal government might remove regulatory hurdles that discourage energy efficiency. In addition, DOE will spearhead a comprehensive effort to improve the energy efficiency of the Federal government's own operations and purchases.

The third step is the promotion of an environmentally-responsible electricity restructuring bill, which the President identified as part of his domestic climate change package in his address to the National Geographic Society on October 22. An electricity sector freed from government regulation would be a more efficient energy sector. Costs to consumers would fall. In addition, stronger incentives for improved generation efficiency in conjunction with appropriate market based provisions could achieve modest reductions in emissions. A reasonable overall estimate of the contribution of federal electricity restructuring to the rest of the President's program to address climate change is that it would make further progress to the same emission reduction goals at a cost saving of roughly $20 billion per year. These steps should be taken regardless of Kyoto, because they make sense in terms of energy efficiency. But they have the added benefit of preparing us for Kyoto.

Estimated Reduction in Costs from Annex I Trading

In the language of the treaty, "Annex I," is the set of countries that have agreed to take on binding limitations in emissions of greenhouse gases. Even without meaningful developing country participation — which, again, the President has emphasized is essential before the treaty would be submitted for ratification — costs could be reduced substantially by emission trading among the Annex I countries. To provide some indication of the possible efficiency improvements, Russia and Ukraine consume six times as much energy per dollar of output as does the United States. Such large international differences in energy efficiency suggest that adoption of existing U.S. technology would yield very large emissions reductions in these countries.

Estimates derived from the SGM model confirm that emissions trading among Annex I countries can reduce the cost to the United States of achieving its targets for 2008-2012 emissions by about half relative to a situation in which such trading was not available. This concept of costs is meant to capture aggregate resource costs to the US economy, including the cost to domestic firms of purchasing emission permits from other countries where emission reductions may be cheaper than in the United States. Although these estimates reflect idealized international trading in efficient markets, the overall conclusion is clear. The dramatic reduction in costs potentially available from Annex I trading within the SGM model — cutting the costs involved by half — highlights why the President insisted that international trading be part of the Kyoto Protocol; and why its achievement by our negotiators in Kyoto was such an important accomplishment.

Estimated reduction in costs from umbrella trading

One possibility that emerged in Kyoto, which none of us foresaw, was the idea developed there by the U.S. delegation, that the United States might undertake trading with a subset of Annex I countries, dubbed the "umbrella". Countries that have expressed interest in the umbrella include the United States, Australia, Canada, New Zealand and Russia, with strong indications of interest from some others. This subset of Annex I countries shares a common interest in promoting market-based mechanisms, most specifically, fully flexible rules for international trading of emissions permits.

It is too early to state the precise form the umbrella will take. But we can envision a number of potential benefits. The umbrella could, for example greatly reduce costs to the U.S. Results that we have derived from various SGM simulations of efficient international trading suggest that, relative to the situation in which there is no trading at all, the umbrella can reduce costs by an estimated 60-75 percent, depending on whether the former Warsaw Pact countries fall within the umbrella. The Kyoto Protocol classifies these countries outside of the EU bubble for the first budget period 2008-2012.

Estimated reduction in costs from developing country participation

The next consideration is participation by developing countries. The President has said that he will not submit the treaty for ratification without meaningful participation by key developing countries. Such participation would further reduce the costs involved.

The substantial potential gains from meaningful developing country participation are highlighted by the significant benefits that will likely accrue from the limited role that the developing countries have already agreed to: the Clean Development Mechanism (CDM), modeled after the U.S. joint implementation concept. The CDM cannot realistically be expected to yield all the gains of binding targets for developing countries, but it might shave costs by roughly another 20 to 25 percent from the reduced costs that result from trading among Annex I countries.

Another possibility is that we persuade some of the key developing countries that are the largest emitters to commit to targets, and allow us to buy emission reductions from those paths. Simulations with the SGM model suggest that full participation by non Annex I countries could cut roughly 55 percent off the reduced costs that result from Annex I trading. The actual cost reduction would depend on the extent of developing country participation that is ultimately obtained, as well as the effectiveness of international trading arrangements. The more developing countries that take on modest binding targets and trade in international permit markets, the lower will be costs.

These cost-saving opportunities are fundamental tenets of the U.S. position. The promise of Kyoto cannot be achieved without effective emissions trading. Moreover, if we do not get meaningful participation by key developing countries, we won't submit the treaty for ratification to the Senate. So, while our analysis may be predicated on some ambitious conditions concerning trading and developing country participation, it is exactly those conditions that form the foundation of the U.S. position in international negotiations including those at Buenos Aires.

Accounting for Carbon Sinks

The preceding discussion has emphasized the importance of trading arrangements and the CDM. In reaching an overall economic assessment, it is also important to factor in the potential role of carbon sinks. Again, the U.S. delegation obtained a novel concept, that carbon absorbing activities called sinks could be used to offset emissions. The arrangements concerning carbon sinks in the Kyoto Protocol have received less attention than they merit. The Kyoto Protocol specifies that removals of CO_2 by sinks count toward meeting the target. The Kyoto Protocol counts the net emissions effects of three sink activities — afforestation, reforestation, and deforestation. Very preliminary estimates of the implications for the United States of the Kyoto provision on sinks indicate that carbon sinks could comprise a significant portion of the total required emissions reductions. Moreover, decreasing the required emissions reduction by, for example, 10% would likely result in cost-savings greater than 10%.

Even this estimate of the effect of sinks is conservative in one respect: it is based on an assumption for sink activity in the U.S. over the 2008-2012 period, and no assumed benefits from sinks elsewhere in the world. Very preliminary estimates suggest that incorporating the gains from sinks throughout the world can substantially reduce the costs of meeting the Kyoto target, on top of the gains from trading among Annex I countries. (Furthermore, no model has yet even tried to take into account that government policies can help increase the activities qualifying as allowable sinks, like some tree-planting.) Because the quantitative uncertainty is so large, we do not yet have an estimate with which we are comfortable. But we expect that complete modelling of the Kyoto provision pertaining to sinks will likely have favorable and potentially large effects on projected costs.

Accounting for the role of improvements in energy efficiency

Another issue in analyzing the Kyoto protocol concerns future improvements in energy efficiency due to innovation and diffusion of existing technology. The parameter that figures most prominently in analysis of energy efficiency is the rate of improvement in the so-called Autonomous Energy Efficiency Index (AEEI), that is the rate at which the total use of energy falls relative to GDP. A plausible assumption on the AEEI is an improvement of 1.0 percent per year. Reflecting a conservative interpretation of the 15-year impact of various climate change initiatives, this is only a small increase above the 0.9 percent number in the Energy Information Administration's Annual Energy Outlook. That assumption is not the most optimistic outcome that might occur. Some authorities in the field of energy policy forecast more rapid technological progress. Experts at five national laboratories managed by the Department of Energy, using an engineering approach rather than an economic paradigm, found that a third of the emissions reductions necessary to return to 1990 levels by 2010 could be achieved through the adoption of existing energy-efficient technologies at no net resource cost, or even some savings. The National Academy of Sciences reached qualitatively similar conclusions in a 1992 report.

The President's FY 1999 budget, as I have noted, includes a $6.3 billion package of tax cuts and R&D investments intended to spur the discovery and adoption of new technologies. If the Administration is successful in this effort, the rate of improvement in energy efficiency could rise and such improvements would lower the cost of meeting our Kyoto target. For example, published results based on SGM model simulations with different assumed rates of AEEI suggest that an increase in the AEEI of 25 percent could lead to declines in the permit price of approximately 40 percent.

Our justification for incorporating into our assessment a small assumed impact of Administration technology policies is somewhat analogous to the Administration's rationale for employing mainstream economic assumptions in our budget forecasts: in the presence of uncertainty, we are conservative in our estimates of the speed with which the economy will grow, tax receipts will rise, and the budget will improve. That way, any revisions or surprises that occur are likely to be in the pleasant direction. In this instance, we prudently and conservatively assume that there will be substantial delays between investments in new technology or the diffusion of existing technology, and the returns to such investments.

Moreover, at the recent automobile show in Detroit, General Motors announced that it has developed a hybrid-based vehicle that can achieve fuel efficiency of 80 miles per gallon, and that this car could be in commercial production within a few years. Ford also exhibited a prototype of a light-weight highly fuel efficient sedan that could be in commercial production by the middle of the next decade. These announcements followed an earlier breakthrough announced by DOE and its partners of a fuel cell that could run on gasoline and double current fuel economy while reducing conventional air pollution emissions by 90 percent. These technological advances have been made possible through the efforts of the Partnership for a New Generation of Vehicles between the Administration and the U.S. auto companies and their suppliers.

Such progress may be replicated in other sectors. VCRs and TVs, while switched off, consume about $1 billion worth of electricity annually. EPA has established a partnership with major manufacturers that has a goal of achieving up to a 70 percent reduction in energy use by VCRs and TVs while they are switched off, without sacrificing product quality, usefulness, or increasing costs. This partnership offers promise of substantial improvements in energy efficiency.

Non-Climate Benefits

A final factor that should be included in any comprehensive assessment of the economic implications of the Kyoto protocol are the benefits of the agreement. The literature has emphasized that any relative price shifts that prove necessary to reduce emissions should produce non-climate benefits in three areas: traffic congestion, highway accidents, and air pollution unrelated to climate change. These benefits are hard to quantify precisely but are potentially significant: our rough estimates suggest that these three benefits could offset approximately a quarter of the resource cost of the climate change policy.

Synthesis

A comprehensive evaluation of the economic impact of the Kyoto Protocol must integrate all of the factors described above: reliance on flexible market-based mechanisms domestically; international trading and Joint Implementation among Annex I countries; the Clean Development Mechanism; meaningful developing country participation; the potential cost-mitigating role of including six gases and carbon sinks; the benefits of electricity restructuring; and emissions reductions achieved as a consequence of other proposed Administration climate change initiatives. Assuming that effective mechanisms for international trading, Joint Implementation and the Clean Development Mechanism are established, and assuming also that the U.S. achieves meaningful developing country participation, our overall assessment is that the economic cost to the United States in aggregate and to typical households of attaining the targets and timetables specified in the Kyoto Protocol, will be modest.

This conclusion that the impact will be modest is not entirely dependent upon, but is fully consistent with, formal model results. I have previously emphasized the limitations of relying on any single model in assessing the economic impact of the Kyoto Protocol, and continue to view any such results as just one input into an overall analysis. But it is worth emphasizing that model results reflecting the details of the Kyoto Protocol are consistent with our conclusion. For example, under the assumptions of either trading under the umbrella or within Annex I, the CDM and permit trading with developing countries, estimates derived using the SGM model, which adjust for the inclusion of six gases and assume little banking of credits beyond 2012, suggest that the resource costs of attaining the Kyoto targets for emission reductions might amount to \$7 to \$12 billion per year in 2008 to 2012. This implies that overall costs, excluding not only climate and non-climate benefits, but also such cost mitigating factors as sinks and payoffs from the President's electricity restructuring and climate change initiatives, would reach roughly one tenth of one percent of projected GDP in 2010.

A more tangible measure of costs is the estimated effects on energy prices. Excluding the impact of electricity restructuring and the ancillary benefits of mitigation and better forest management, the SGM-based estimate, corresponding to the gross resource cost estimate cited above, is an emissions price in the range of \$14 to \$23 per ton of carbon equivalent. This translates into an increase in energy prices between 2008 and 2012 at the household level of between 3 and 5 percent, an increase in fuel oil prices of about 5 to 9 percent, natural gas prices of 3 to 5 percent, gasoline prices of 3 to 4 percent (or around 4 to 6 cents per gallon), and electricity prices of 3 to 4 percent. This increase in energy prices at the household level would raise the average household's energy bill in ten years by between \$70 and \$110 per year, although such predictions may not be observable because they would be small relative to typical energy price changes, and nearly fully offset by electricity price declines from Federal electricity restructuring. In particular, this increase in energy prices is small relative to the average of year to year real energy price changes experienced by U.S. consumers since 1960: such annual changes have averaged 3.8 percent. In addition, by 2008-2012, the anticipated 10 percent decline in electricity prices from the restructuring that is part of our climate change agenda is projected to lead to expenditure reductions of about $90 per year for the average household.

As highlighted earlier, there are substantial but unavoidable uncertainties surrounding estimates like these. For example, the estimate just discussed is predicated, among other things, on the developing country participation that we are insisting upon as a condition for our ratifying the Kyoto Protocol, but which is not yet part of that Protocol, and on effective international trading. Moreover, other models will yield other answers and much work remains to be done by the modeling community to test the robustness of these results. Preliminary comparisons of the SGM model to the few other models that have attempted to evaluate the Kyoto accord, suggest that its predictions concerning the impact of the Kyoto Protocol on carbon permit prices are neither the most conservative nor the most optimistic of the models that have been developed. The predictions of the SGM model are robust in the sense that virtually all energy models reveal the potency of effective, flexible, domestic and international trading mechanisms to reduce substantially the cost and energy price impact of meeting the Kyoto targets.

Of course, the most important factor that has been left out of the above assessment is the benefit of mitigating climate change itself. A full cost-benefit analysis would include mitigation in the benefits column. The only reason we have not done so, explained repeatedly above, is the difficulty in coming up with a number to capture the monetary benefits. But nobody should lose sight of our ultimate objective — keeping our planet the hospitable home that we enjoy today.

Effects on employment and aggregate output

So far we have said nothing about job losses resulting from climate change policy. Although there may be job gains in some sectors and job losses in others, we do not anticipate any significant aggregate employment effect if we achieve the conditions we have discussed. The effects on energy prices described above will occur only 10 to 14 years in the future. Not only are these effects small relative to historical variations in energy prices, and offset by other policies like electricity restructuring, they would occur sufficiently far in the future to enable monetary policy to keep the economy operating at its potential. In energy-intensive sectors some employment reduction could occur, although given the very small predicted change in energy prices, impacts in most such sectors are apt to be minimal. Furthermore, a large number of jobs will be created in other sectors — many of them high-tech jobs paying high wages. The President is firmly committed to assisting any workers who are adversely affected during the transition to a climate-friendly economy.

VII. Conclusion

In conclusion, the Kyoto Protocol and the President's general approach to climate change reflect the insight of economic analysis. The Kyoto Protocol includes key provisions on international trading and Clean Development projects. The President's approach relies on market incentives — first, with a system of tax cuts and R&D investments, and then later with a market-based system of tradeable permits — to ensure that our objectives are achieved as efficiently as possible.

Our overall conclusion is that the economic impact of the Protocol will be modest under the conditions we have identified. The purpose of this testimony has been to explain the reasoning underlying this conclusion, which draws insights from not only the forecasts of individual models, any one of which has its own strengths and limitations, but also a broad variety of additional analyses.

I look forward to continuing to work with members of this Committee, as well as other interested parties, in further analyzing the Kyoto Protocol and evaluating the net effects of reducing greenhouse gas emissions. It is my hope that economic analysis will continue to play a key role in designing policies in this area.

I welcome your questions.

Secretary of State Madeleine K. Albright
Remarks on Earth Day 1998 at the National Museum of Natural History
Washington, DC
April 21, 1998
As released by the Office of the Spokesman U.S. Department of State

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As Delivered

Earth Day 1998: Global Problems and Global Solutions

SECRETARY ALBRIGHT: Thank you very much. Thank you, Director Fri, for introducing me, and thanks to the Museum of Natural History for sponsoring this event. From the Hope Diamond to the blue whale to the multi-legged attractions of your Insect Zoo, the wonders of the world are on display here; and I can think of no better place than this to recommit ourselves to our planet's environmental health.

Before I start, I want to recognize, especially, Chairman Ben Gilman of the House Committee on International Relations, Congressman Farr, and some members of the diplomatic corps: Ambassador Flecha de Lima of Brazil, Ambassador Chandra of India, Ambassador Tuerk of Austria, and Ambassador Hannibalsson of Iceland. I'm very glad that you all were able to make it.

Dr. Baker, I also want to thank you for your fine, clear and objective presentation, and to congratulate you on the wonderful job you are doing at NOAA — especially during this, the Year of the Ocean.

Now, saving a planet is a pretty big job, even for the Smithsonian and NOAA. But for those of you who may be daunted by the challenge, let me remind you of the Gary Larsen cartoon some time back in which a dinosaur, after prolonged study, says to his comrades: "Friends, the outlook is bleak: the world's climate is changing; humans are taking over; and we each have a brain the size of a walnut."

(Laughter.)

So take heart, things could be worse.

Earth Day was first celebrated in 1970, which was not a quiet time. The Vietnam War was at its peak; Middle East tensions were high; the entire world was split between red, white and blue on the one hand and just plain red on the other. And there were deep divisions here at home over the economy and the plight of our cities. But still, environmental concerns broke through. How could they not? Americans could see, smell and feel the difference pollution was making in our lives. Smog was everywhere; rivers and lakes were unfit for swimming; and there had been a major oil spill in Santa Barbara.

The next few years were a remarkable period. I know, because I was working then for Senator Ed Muskie of Maine, who taught me, really for the first time, to think green. Senator Muskie and his colleagues in a Democratic Congress joined forces with a Republican President, and together, they enacted laws that would do much to clean our waters, improve air quality, protect endangered species and safeguard the transportation of oil and other hazardous materials.

Some opposed these steps, saying they were not needed and would threaten prosperity. Some questioned the science, arguing that fish grow well in polluted waters, which they do — they grow extra heads.

(Laughter.)

And some argued that we would become uncompetitive if we insisted on having air we could breathe, while other nations did not.

Today we may be thankful that the decision-makers of the 1970s didn't listen—if I may borrow a phrase from that era—to the "nattering nabobs of negativism." Instead, they took the steps that would make our country healthier, cleaner and more competitive. We owe them a debt of gratitude, and today we should commit ourselves to following their example.

The threats we face from environmental harm are not as spectacular as those of a terrorist's bomb or missile. But we know that the health of our families will be affected by the health of the global environment. The prosperity of our families will be affected by whether other nations develop in sustainable ways. The safety of our families will be affected by whether we cut back on the use of toxic chemicals. And the security of our nation will be affected by whether we are able to prevent conflicts from arising over scarce resources.

There is much that we can do through our diplomacy to achieve these goals. Currently, to cite just three examples, we are promoting efficient management of the Nile River Basin; supporting better forestry practices in Southeast Asia; and striving to negotiate a worldwide ban on the release of pollutants such as DDT and PCBs. But if we are to move ahead as rapidly as we would like, we will also need support from our friends in Congress.

For example, we need to gain approval of the President's request for funds for USAID so that we can help other countries grow in ways that balance economic progress, social development and environmental concerns. We need support for the Global Environment Facility (GEF), which embodies the partnerships for sustainable development that was forged in Rio. This partnership is not helped by the fact that, in each of the last three years, we have fallen short of our pledged share to the GEF. We need to do better than that. We need to meet our commitments, in full, this year and every year.

As the President stressed during his recent trip to Africa, we are asking the Senate to approve the Convention Against Desertification. We are also asking the Senate to approve the Biodiversity Convention, for we cannot ensure our future if we endanger the biological base that serves the needs of every human society, no matter how rich or poor.

For example, many improvements in the production of food can be traced to crossbreeding plants; and nature has provided the key to many other secrets we very much want to know. The names may be peculiar, but the subject is serious, for in the Rosy Periwinkle researchers found a treatment for childhood leukemia; in the Pacific Yew and Australian Coral, treatments for ovarian and breast cancer; in the Poison Arrow Frog, a painkiller without the side effects of morphine; and yet another cancer treatment has been produced in the laboratory through the combined efforts and excretions of jellyfish and glow worms.

Now, just today there was a study that came out. A majority of the nation's biologists are convinced that a mass extinction of plants and animals is underway that poses a major threat to humans in the next century; yet most Americans are only dimly aware of the problem, this poll says. The rapid disappearance of species was ranked as one of the planet's gravest environmental worries — surpassing pollution, global warming and the thinning of the ozone layer, according to a survey of 400 scientists commissioned by New York's American Museum of Natural History. So we are involved in dealing with a very, very serious problem.

The Administration believes we can implement the Biodiversity Convention in a way that protects our commercial interests while enabling those who protect biodiversity to share in the benefits. That makes business sense, environmental sense, scientific and medical sense. And so I hope the Senate will use common sense and approve the Biodiversity Convention as soon as possible.

A major contributor to the stress we place on the global environment is the growth in the world's population. At current rates, we are increasing by an amount equal to the population of Mexico each year. And more than 90 percent of this increase is in the developing world. As I have seen in visits to South Asia, Africa, Latin America and Haiti, rapidly rising populations make it harder for societies to cope. Even when economies grow, living standards do not rise. Even when there is planning, resources of land and water are depleted. Even when overall production of food goes up, more people go hungry.

The Clinton Administration favors a comprehensive approach that takes into account the environment, development and the rights and needs of women. This accords with the consensus created at the 1994 Cairo Conference, and it is reflected in our Child Survival and Disease Programs, and in our support for international family planning.

As is well known, there are those who would like to impose crippling conditions on our assistance to family planning. On this issue there are strong feelings on all sides. I know because my own feelings are strong, and I believe international family planning needs and deserves our support. The programs we help are voluntary. They improve people's health; they save people's lives; they reduce significantly the number of abortions; and they contribute to a more livable world.

Finally — and this is the subject I want to emphasize today — we must act with others around the world, not years from now but now; not with timidity but resolve, to combat global climate change.

This problem affects us all. And as Dr. Baker made clear, and as leading scientists agree, greenhouse gases are warming our planet. This means, to use formal diplomatic language, that we should all "get ready to get sweaty."

(Laughter.)

A warming planet is a changing planet, and not for the better. Unless we act, sea levels will continue to rise throughout the next century, swamping some areas and putting millions of people at greater risk to coastal storms. We can expect significant and possibly sudden changes in agricultural production and forest ecosystems, leading to modified migrations of wildlife and larger migrations of people. We will also see more heat-related deaths, more serious air quality problems, increased allergic disorders and more widespread malaria, cholera and other infectious diseases.

Unlike Dr. Baker, but probably like most of you, I am not a scientist. I am also something of a skeptic. We all know of times in the past when prophets of doom and gloom were proven wrong; when predictions that we would soon run out of food, water or air did not come true. So I am no Chicken Little. But I note that the scientific backing behind the current projections is the Intergovernmental Panel on Climate Change, representing the work of more than 2,000 scientists from more than 50 countries. If you review their report, you see that it is carefully worded, factually based and that it recognizes the uncertainties as well as the risks. But all that aside, I have been on Earth now for sixty years, and I have never witnessed weather of the kind I have seen, read about and heard about these past few years.

As Secretary of State, I cannot count the number of times I have called foreign leaders to offer help in response to weather-related disasters. In Africa, Asia and just across our southern border in Mexico, the effects of El Nino have had a devastating impact on coastal populations. Globally, nine of the last 11 years have been among the warmest in this century. And here in the United States, heavy downpours of rain are up 20 percent. In recent years, we have seen floods in California, the Pacific Northwest and along the Mississippi; drought in the Plains States; and tornadoes in Florida, Alabama and, this past week, in Tennessee, Arkansas and Kentucky.

Freakishly bad weather brings with it far more than the need for new umbrellas and boots. The human and financial costs are enormous. Storms kill people. They destroy houses and livestock, disrupt food production and require huge outlays for humanitarian relief.

It is true that we can't point to El Nino, or to any individual storm or drought, and say global warming made it happen. But we can point to the pattern and say it is consistent with the trends that scientists believe global warming would create. And we can ask ourselves, is more and more of this what we want for our children?

Our choice is clear. We can keep pumping more carbon dioxide into the atmosphere every year, invite greater and more severe climate change and simply let future generations deal with the consequences. Or we can begin to act now to protect our planet — our children's home.

The Administration has chosen the latter course. We favor a comprehensive global climate change agreement in which nations consent to binding targets on future greenhouse gas emissions. We took an essential step towards that goal this past December in Kyoto. There, for the first time, the industrialized nations agreed to mandatory targets. These vary from country to country, with the United States pledging to meet a standard 7 percent below 1990 levels within the next ten to 14 years.

This is appropriate, because if we are to slow global warming, the United States must help show the way. We have less than one-twentieth of the world's people; but we generate one-fifth of all greenhouse gas emissions. This reflects the size of our economy; but it carries with it a responsibility. That is why the President has unveiled three major initiatives within the last nine months to stimulate the development and use of clean technologies.

Our efforts can accomplish a great deal. They can set an example for others to follow. They can expand our knowledge and reduce the cost of innovative technologies and techniques. They can create more and better jobs in America's huge and highly competitive environmental manufacturing and services sector. And they can help restrain the growth in greenhouse gas emissions. But our efforts alone cannot solve the problem.

It is expected that within two decades, the largest emitter of greenhouse gases will not be the United States, but China; and that by ten years after that, the developing world will have become the source of the majority of such emissions. Industrialized nations created the global warming problem and must take the lead in responding. But clearly we will not find a solution unless developing countries are a part of it.

And that's why President Clinton has said that he will not submit the Kyoto Protocol for the Senate's consideration until there is meaningful participation by developing countries. To make this easier, we are building partnerships with many of these countries so that they may take advantage of the latest clean technologies. This will help them grow in ways that do not harm the environment.

In this connection, I am pleased that we are joined here today by executives from US utilities who are working through the USAID/US Energy Association Partnership Program to promote clean energy growth in developing countries.

Of course, meaningful participation will require something far different from a poor and non-industrialized nation than from one that is densely populated and on the threshold of developed status. As Senator Robert Byrd has said: "binding commitments for developing nations should be paced according to the ability of each country to achieve limitations appropriate to its national circumstance and economic growth." Obviously, we cannot take a cookie cutter approach. Our goal is to establish and build a dialogue that takes into account the needs of every nation, and that leads every nation to conclude that the fight against global warming is everyone's battle and in every nation's interest.

Although we still have far to go, there are grounds for optimism. Some less developed nations, particularly island nations, are among the most vulnerable to sea level rise and weather extremes. They are also among the leading supporters of efforts to combat climate change. Second, many developing nations have constituencies who understand the dangers of global warming and who want the world, including their own governments, to respond. Third, actions that reduce greenhouse gas emissions are often not a burden, but an opportunity. Many developing countries have already moved, as in China, to increase reliance on co-generation; or as in Mexico, to establish energy efficiency standards; or, as in Brazil, to make greater use of ethanol. Such steps cut energy costs, save natural resources, reduce health care expenses and increase competitiveness.

This is a point I heard President Clinton make repeatedly this past weekend at the Summit of the Americas in Chile. He said that, time after time, we in the United States have been warned that environmental safeguards such as emission standards would harm our economy; and time after time, we have acted anyway and found our economy did not shrink, but grow, and that we did not become less competitive, but more. In part because of the President's persistence and persuasiveness, this is a message more and more countries are beginning to accept.

Finally, the parties agreed in Kyoto to something called the Clean Development Mechanism. This provides a financial incentive for firms from developed countries to invest, for example, in building environmentally friendly power plants in the developing world. Under this arrangement, participants would share certified emission reductions, and both the investing and host countries gain.

So when I sit down with my counterpart from a developing country, this is the argument I make. If your country agrees to participate in the effort to limit climate change, your economy will continue to grow, but with greater access to new technologies that will make you more competitive. Your exports will be welcome because the world will know they were not produced by undercutting environmental standards. Your citizens will enjoy a higher quality of life because you will have found the path to greater prosperity without sacrificing breathable air, drinkable water and livable cities. Your nation will have earned respect by its willingness to lead on a matter of fundamental importance. And your people and their children and their children's children will all benefit from a global climate change agreement that is far more likely to be implemented by industrialized nations, including the United States, than if you did not participate.

Today, I am announcing a diplomatic full court press to encourage meaningful developing country participation in the effort to combat global climate change. We are pushing this matter hard in bilateral discussions around the world. As I said, it was on the agenda of the Summit of the Americas. I will raise it in Beijing and Seoul during my trip to East Asia next week. We will be discussing it in the United Kingdom at the G-8 meetings next month; in Manila at the ASEAN meetings in July; and at the UN General Assembly this fall.

To make these efforts as effective as possible, I will be appointing a special State Department Coordinator for Global Climate Change to make sure our diplomatic efforts on this issue are creative, constant, consistent and coordinated. That individual will work closely with the White

House and other agencies, and in the State Department with senior negotiator Under Secretary Stu Eizenstat and Acting Assistant Secretary Melinda Kimble. This decision reflects the importance we attach to this issue, and the fact that we want a global climate change agreement that is truly global and that will truly work to preserve the health of the environment upon which every nation depends.

It is said that nine-tenths of wisdom is being wise in time. We are about to enter a century in which there will be far more of us, living closer together, consuming more, expecting more and demanding more. Inevitably, we will be participants in a race between the "using up" that results from human activity, and the ability to adapt that can result from human genius.

Policy-makers must be willing to make hard decisions. We can't simply assume that science and technology will provide the answers for us. We must work together on a bipartisan basis to design rules and nurture habits thatrespect the limits of our natural environment.

Whether the immediate issue is global warming or conserving fish stocks or managing forests, the fundamental issue is the same. And that issue is respect: respect for ourselves, because that's what it takes to accept responsibility for the consequences of our actions; respect for those in other countries, because upon their well-being depends our own; respect for future generations, because we have an obligation not only to educate and prepare our children for the world, but also to protect that world for our children; and respect for nature itself, because we, of all creatures, have been given both the power to destroy our planet's capacity to sustain life and the ability to appreciate and enjoy all of its wonders.

It is said that the meek shall inherit the Earth. But it will take boldness and action to save it. On Earth Day 1998, let us each pledge to treat our shared environment with respect, and to act with determination to safeguard it for generation upon generation to come.

Thank you very much.

(Applause.)

Secretary of State Madeleine K. Albright
Address to the Australasia Centre of the Asia Society, Sydney Opera House
Sydney, Australia
July 30, 1998
As released by the Office of the Spokesman U.S. Department of State

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As Delivered

Thank you very much Foreign Minister Downer, Mr. Morgan, Ambassador Peacock, Ambassador Woolcott, and good afternoon to you all. I am very glad to be here, and to be joined by America's Ambassador to Australia, Genta Hawkins Holmes, as well as by our Consul General in Sydney, Rich Greene.

I am very, very glad to be here and have the opportunity to address this august group in this magnificent hall. Before Mr. Downer mentioned my singing, I haven't had a chance to sing in a place with acoustics such as this (laughter). Maybe I wouldn't have been described as someone who had to save their singing for the shower (laughter).

It is indeed a pleasure to also be in the Olympic City. I have never been to Australia before but I am having a wonderful visit already and looking forward to my return for AUSMINS in the Olympic year. It was very clever of us to plan to have it here that year, and the reason I'm here this year is to make sure that I get tickets (laughter).

As some of you may know, before I became a diplomat, I was a university professor, and I've missed being called Dr. Albright, I like that. Thank you, Secretary is great but Doctor I like also. And from time to time, I would ask my students to put aside the map of the world Americans customarily use, which has the western hemisphere at its center and leaves chunks of Asia and Australia divided and at opposite ends.

Instead, I would take a globe and spin it around 180 degrees, and I would ask my students to consider the world anew, from the perspective of Japan or China or the peoples of Oceania. And what was remarkable was how rarely they had been asked to do that, to shed their normal skins and think from a different point of view.

I mention that this afternoon because this society encourages a similar brand of unconventional thinking among the diverse peoples of the Asia Pacific. And as we prepare for the 21st century, there is no work more important.

From the Aleutians to Auckland and from Sumatra to Seoul, technology is bringing populations from vastly different worlds into daily contact with one another. But contact does not ensure clear communication, much less understanding. To achieve that, we must work hard to see that the differences that distinguish and define us do not obscure the common interests and values that bind us.

Fortunately, when it comes to the Asia-Pacific region, there is no better example of cooperation built on shared values and interests than the relationship between the United States and Australia.

On the map, we could hardly be further apart. But as defenders of freedom and advocates of the rule of law, we cannot be separated. For decades, we have stood shoulder to shoulder both in time of peace and through five wars.

Today, our alliance is an anchor of regional stability. We are vigorous trading partners. Our people visit each other, attend each other's schools, do business with each other, learn from each other and collaborate on everything from eradicating disease to fighting terror.

Obviously, we don't always see eye to eye. In some economic sectors we're competitors as well as partners. Globally, our roles are not the same. Regionally, Australia's perspective is sharpened by its proximity to the Asian mainland. But on the big things, on the central issues of democratic government, the pursuit of prosperity and the desire for peace, we are true allies, valued partners, and I hope eternal friends.

I look forward to reaffirming our alliance tomorrow when Secretary of Defense Cohen and I meet with Foreign Minister Downer and Defense Minister McLachlan. The AUSMIN reflects the indispensable nature of our cooperation, and gives me confidence that everything that can be done to maintain the security and peace of this region will be done.

Earlier this week, Foreign Minister Downer and I both attended meetings of the ASEAN Regional Forum and Post Ministerial Conference. There, the convergence of U.S. and Australian interests in Asia was evident.

For example, in the aftermath of the South Asia nuclear tests, we agree that the nuclear non-proliferation regime must be buttressed and its value reemphasized. Every effort must be made to reduce tensions and prevent a nuclear arms race in the region. And every nation in the world should agree, as the Comprehensive Test Ban Treaty provides, never again to conduct a nuclear explosive test.

We concur on the importance of maintaining stability on the Korean Peninsula. Both our nations support the Agreed Framework under which North Korea has pledged to freeze and dismantle its nuclear weapons program. Australia understands how critical this effort is. It has done more to support the Korean Energy Development Organization than any nation apart from Japan, Korea and the United States. And I applaud your government's decision to contribute additional funds to KEDO, and I thank you for that.

Our countries both understand the strategic significance of China and the key role it will play in determining whether the Asia-Pacific remains stable. And we agree that China should be encouraged to define its interests in ways compatible with the stability and prosperity of its neighbors, and to observe international norms on proliferation and human rights.

President Clinton's recent trip to China reflected progress toward both these goals. He conveyed a message of freedom and friendship directly to the Chinese people. He drew the connection between individual liberty and competitiveness in the global economy. And he stressed the importance of halting the spread of dangerous weapons and technologies.

I was encouraged by the recent trend toward greater openness in China. At the same time, I have been disturbed by the recent detention of religious and political activists, and I said so to Chinese Foreign Minister Tang when we met in Manila.

Engagement with China brings benefits to both our nations. But engagement is not the same thing as endorsement, and we should continue to speak frankly about the problems that remain.

The United States and Australia are both strong supporters of democracy in Cambodia. As we have seen again this past weekend, the Cambodian people desperately want to make democracy work. We hope that the balloting will produce an outcome that genuinely reflects their wishes. But we don't yet know if that has happened.

It is just clear, that twice now in less than a decade the Cambodian people have gone to elections in record numbers that I would only wish were emulated in other countries. We must also remember that the purpose of the election was not to make it easier for us to declare success in Cambodia and walk away. It was to give the Cambodian people a chance to start anew a democratic process that was arrested when the coalition government disintegrated last year. To encourage that process to continue, we must stay engaged, keep the pressure on, and make our assistance to any government conditional on its respect for international norms.

Our nations also agree that it is past time for Burma to rejoin the family of democratic nations, and here your Foreign Minister and I had another chance to work together in Manila. Regrettably, the Burmese regime is pursuing a policy not of dialogue but of denial. Today, Aung San Suu Kyi, who was marking her sixth day in a standoff, was all of a sudden taken in her car by a military driver back to Rangoon and thereby forbidden from exercising a basic human right, which is the ability to travel freely in your own country. We have just heard this news and Foreign Minister Downer and I have spoken about it. We think that this is an unacceptable violation of her human rights and it will only contribute to the further isolation Burma, a country whose people are suffering because the government is not moving in a way to have the kind of dialogue and democratic discourse that is necessary. Aung San Suu Kyi is a remarkable person and has fought for the freedom of the Burmese people. She is entitled to be able to go on doing that in a way that strengthens democracy.

Australia and the United States worked in Manila to do what we could to break the impasse, and we will continue to work together throughout this episode. All my experience in life and diplomacy tells me that our engagement can make a difference, and that change must eventually come to Burma. Concerted international pressure can make it harder for the regime to resist reform. Diplomacy can offer it face saving ways to compromise. Our nations should pursue both tracks and deepen our cooperation on this issue.

Finally, and perhaps most important, both our nations have an interest in seeing that confidence is restored to the troubled economies of East Asia. With today's global market, problems in one place can and do affect people every place. Nations that export to Asia, and both our nations export a great deal, are being hurt.

But the potential costs are far greater than lost exports. Misery can give rise to mistrust among nations; poverty can push desperate people across borders; economic despair can lead to disillusionment with economic and political freedom. And I applaud Australia for its contributions to IMF funding arrangements for Thailand, South Korea and Indonesia.

The United States is also doing its share through support for the IMF and World Bank, and through the direct assistance we are providing to meet emergency humanitarian needs. We're stressing the importance of reforms that will attract investors and lead to more open and accountable management of economies in the region. We're also encouraging Japan to stimulate its economy so that it may once again become an engine of growth.

No nation has been hit harder by the financial crisis than Indonesia, traditionally a source of stability and growth within the region. The United States is determined, and I know Australia is, to help Indonesia meet the humanitarian needs of its people. We both hope Indonesia will emerge from this crisis not only as strong and prosperous as ever, but with the commitment to democracy it needs to stay strong and prosperous for good.

As friends and allies, the United States and Australia work together to resolve amicably the differences that arise in our own relationship. And we cooperate in regional efforts to build security, prosperity and peace.

But in our era, that's not enough. Every nation, no matter its size, location, or state of development is vulnerable to global threats such as trafficking in drugs and human beings, the spread of AIDS, and terrorism. On each of these issues, cooperation between our nations and people is solid. We believe in law. And as the recent tragedy in Papua New Guinea demonstrated, we will reach out and help those in need.

Yesterday, I visited Papua New Guinea. It was tremendously moving to see how that nation is coping with the tragedy of the tidal wave, and tremendously gratifying to be able to bring with me tangible expressions of American support for its people. I did hear again, however this morning, that there has been another earthquake in the region and I think this obviously will only complicate the issues there.

One area of cooperation I want to highlight this afternoon is the environment, which is a multifaceted challenge.

The United States and Australia are both vast countries with abundant resources, diverse wildlife, and spectacular coasts. This gives us a shared stake and a shared opportunity to work together in every part of the environmental area, where we were partners in developing the International

Coral Reef Initiative. And the Great Barrier Reef may be the world's leading example of why coral preservation matters and what strong leadership on this issue can achieve.

We can be allies in the effort to protect endangered species and to ensure that trade in products derived from nature is effectively and fairly controlled.

We have an opportunity to lead in negotiating a bio-safety regime for genetically altered products that will respond to scientific concerns while ensuring that agricultural exports do not become ensnared in unjustified regulations.

We can join forces with others to take on the problem of deforestation, which is caused by poor land management, population pressures, and out of control forest fires.

The problem of fires was particularly acute last spring, when they exacted an enormous toll on the economies of nations and health of people in many parts of this region.

In response, the United States has earmarked $4 million to help improve forest management, fire fighting, and climate prediction in Southeast Asia. But we need to do more, and mobilize more international support to change the conditions that spark such devastation.

Both our nations have the resources and the expertise to promote sustainable agriculture and forest management, to encourage an end to the most dangerous burning practices, and to contribute to the resolution of disputes over land tenure.

But perhaps the most comprehensive long-term environmental challenge facing us all is global climate change.

Leading scientists agree that greenhouse gases are warming our planet. A warming planet is a changing planet, and not for the better. Unless we act, sea levels will continue to rise throughout the next century, swamping some areas and putting millions of people at greater risk to coastal storms.

We can expect significant and sudden changes in agricultural production and forest ecosystems, leading to changing patterns of wildlife migration and forcing more people to leave home and cross borders in search of productive land.

We will also see more heat-related deaths, more serious air pollution, increased allergic disorders and more widespread malaria, cholera and other infectious diseases.

Like most of you, I am not a scientist. I am also something of a skeptic. We all know of times past when prophets of doom were proven wrong; when predictions that we would soon run out of food, water or air did not come true.

So I am no Chicken Little. But I note that the scientific backing behind the current warming projections is the Intergovernmental Panel on Climate Change, representing the work of more than 2,000 scientists from more than 50 countries. Their report is carefully worded, factually based and it recognizes the uncertainties as well as the risks.

Yet in both our nations, we have those who insist that the scientific warnings are wrong; or that, even if they are right, we can't afford to take the steps required to slow the release of greenhouse gases.

But the one thing we truly cannot afford to do is wait and see. For if the warnings are right, the cost of reversing climate change and cleaning up the damage will be infinitely greater than the cost of preventing it.

Our choice is clear. We can keep pumping more gases into the atmosphere every year, invite more severe climate change, and let future generations deal with the consequences. Or we can act prudently to protect our planet, our children's home.

Not without controversy or difficulty, both our nations have chosen the latter course. We are working for a comprehensive climate change agreement, in which all nations contribute to a global solution to this global problem.

We took an essential step towards that goal last December in Kyoto. There, for the first time, industrialized nations agreed to mandatory targets for limiting greenhouse gas emissions. These targets vary from country to country, with the United States pledging to meet a standard of 7% below 1990 levels within the next 10 to 14 years.

As we prepare for the next Conference of the Parties to the Climate Change Convention this November, we will be working closely through the so-called "Umbrella Group," which includes among others the United States, Australia, Russia and Japan. Our goal is to solve this problem in ways that stimulate technological innovation and allow maximum flexibility in achieving the necessary emissions reductions.

I have to say having just recently traveled with President Clinton to China, where it is clear that while the United States is the greatest problem now, they will be the greatest problem. A message that he is delivering is one that I think is key: countries that are so-called developing countries are concerned about how putting in environmentally sound technology will affect their development. And the President argues that no one has the right to tell another country to limit its development. But that those of us that have gone through industrialization can validate the fact that often the economic situation in a country can be actually improved once environmentally sound technology is put in.

I believe ultimately, and I am confident that we can make our environment healthier and keep our economies competitive or even post economic gains through greater efficiency and the use of clean technology.

Our cooperation is also essential to solve the other half of the climate change puzzle, which is to create a global action plan to which both developed and developing nations contribute. This is critical if we want to make not just short-term headlines, but long term improvements. For it is expected that, within two decades, the largest emitter of greenhouse gases will not be the United States, but China. And that, by ten years after that, the developing world will have become the source of the majority of such emissions.

Industrialized nations created the global warming problem and must take the lead in responding. But clearly, no solution will work unless developing countries play a part in it.

Global warming may look like an insurmountable problem, and its potential economic effects can seem too large to confront. But in contemplating the challenge, we should recall the many times when naysayers predicted that protecting the environment would be too hard, too costly, and too cumbersome.

From America's waterways cleanup in the 1970s, to Australia's stewardship of the Great Barrier Reef, to the global effort to close the ozone hole, environmental preservation is working, and it is working in ways that keep our economies growing.

In the eighteen months that I have had the honor to serve as America's Secretary of State, I have been to the Asia Pacific region six times, South Asia once and, last November, to Asia's front door for the APEC meetings in Vancouver. This schedule reflects a simple reality. No region of the world is more important to American security and prosperity, or to the values we share with others, or to our effort to meet new global challenges.

Because of the financial crisis, these are not the best of times for the people of this region.

But friendship, like a sailing ship, cannot be truly tested when the skies are clear and the weather fair. It is during the hard weather and high winds that we learn whether what we have designed is sound, what we have built is sturdy.

America's commitment to the peace and stability of this region and to the freedom and welfare of its people is not a fair weather commitment. Nor is it short lived. It is unshakable now and it will endure.

That commitment is grounded in our own interests. It is consistent with enduring principles of democracy and law. It is made secure by alliance with our closest partners, such as Australia. And it is animated by our hopes for a future far better than the past.

Thank you very much for your attention here this afternoon and for your very kind welcome to beautiful Sydney.

Stuart E. Eizenstat
Under Secretary for Economic, Business, and Agricultural Affairs
U.S. Department of State
Remarks on climate change ministerial
Tokyo, Japan, September 18, 1998

Tokyo Ministerial on Climate Change

The informal ministerial on climate change held in Tokyo on September 17-18 proved very positive, and the United States thanked our Japanese hosts for putting together the meeting. Among the twenty-plus countries invited to attend, there was a strong spirit of cooperation and shared responsibility to continue the progress on climate change begun in Kyoto last December. There was interest in developing a work plan with timetables on the flexibility mechanisms — emissions trading, Joint Implementation, and the Clean Development Mechanism.

An active discussion took place concerning the domestic actions being taken by individual nations. The United States set forth in detail its ongoing and planned efforts, which include existing programs for energy labeling on major appliances, solar energy promotion, and model energy conservation programs in the federal government itself; $1 billion in climate-related assistance to some 44 developing countries over the next five years; as well as President Clinton's $6.3 billion proposal for new, climate-related tax incentives and R&D measures. Both developing and developed countries — from China and Indonesia to Japan and the United Kingdom — made clear their concern about climate change and described national policies and programs that help address climate change.

Discussion of the Clean Development Mechanism, or CDM, which shows real promise as a bridge between the developed and developing countries in their efforts to address the global problem of climate change, was especially productive. Attendees recognized that the projects to be covered by the CDM can create emissions reductions with environmental benefits for us all. The ministers and their representatives generally acknowledged CDM's potential to promote investments in clean growth in developing countries and to help developed countries meet their Kyoto goals, cost-effectively, through project-generated credits against their targets.

The ministerial sparked a frank and lively discussion of emissions trading. It reflected an uncommonly clear sense of the balance needed between ensuring the trading system's integrity through strong rules, and maximizing its ability to generate emissions reductions worldwide by making it simple and transparent and allowing its full and flexible use. Trading is a complex issue and countries have different views on precisely how it should work. The ministerial reflected this, yet also made clear that trading is greatly valued as an innovative and powerful approach to addressing climate change cost-effectively. On that basis, the group was quite positive on balance about the prospects for progress on trading at the Fourth Conference of the Parties — COP4 — coming up in November in Buenos Aires. Based upon improved understanding with the EU, we hope that emissions trading will not be a divisive issue at COP4.

The ministerial gave the twenty-plus attendees an opportunity to consider what can be achieved at COP4 and beyond, but no formal conclusions were reached. A very business-like attitude was taken by the ministers and their representatives, with a strong focus in discussions on identifying common interests and feasible results for COP4. In our meetings, the United States made clear that developing countries must be part of the solution. Meaningful participation by key developing countries is central, with their degree of commitment dependent upon their emissions level and state of development.

The United States sees COP4 as an opportunity to renew momentum on both the UN Framework Convention on Climate Change and the historic Kyoto Protocol. There seems to be a solid basis for developing an approach to completing the elaboration of the flexibility mechanisms — emissions trading and the Clean Development Mechanism.

Our goal is to engage in frank discussions on the areas of shared interest, to develop a consensus on next steps in key areas, and to avoid unproductive arguments on issues that cannot be resolved at COP4. The United States hopes that at COP4, Parties will signal clearly their commitment to move forward, and their understanding of the need for greater certainty among our people and private firms about how the Kyoto mechanisms and processes will work.

The United States will encourage all countries — both developed and developing — to reiterate at COP4 the need for concerted, cooperative action to address this global problem. A concrete step in this regard would be for Parties to renew their commitment to taking actions in the context of the Framework Convention, which recognizes both the "common, but differentiated responsibilities" of developed and developing countries and the need for a global effort.

The United States would like to see greater evidence at COP4 of developed and developing countries working together on climate change. We are encouraging discussion of a broad array of developing country participation activities and acknowledgment of the specific contributions to limiting greenhouse gases many have made. We may also be able to build confidence and shared perspectives by engaging at COP4 with the private sector and the NGOs. These groups have many skills and insights to contribute, and can help us move forward on issues that are technically complex and politically sensitive.

The key to success will be to establish COP4 as a stepping stone to the future of our efforts on climate change, one which is both credible and effective.

Statement of The Honorable Janet Yellen
Chair, Council of Economic Advisors
Before the House Commerce Committee
Subcommittee on Energy and Power
October 6, 1998

Economics of Climate Change

Thank you, Mr. Chairman. I appreciate having this opportunity to discuss with you the economics of climate change and the Administration's efforts to address this significant environmental challenge. As you know, I have testified on this topic before this Committee on two prior occasions. In my first appearance, prior to the Kyoto negotiations, I emphasized that if flexible, market-based mechanisms are effectively used, the costs of cutting greenhouse gas emissions would be significantly reduced. Elaborating on this point, I stated in March of this year that, in the Administration's view, the costs of achieving our Kyoto target would be modest if we can succeed in implementing international trading, joint implementation, and the Clean Development Mechanism in an efficient manner and we achieve meaningful developing country participation. A report released by the Administration in July, entitled "The Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis" elaborates the assumptions and analysis underlying this conclusion. In addition, the Stanford Energy Modeling Forum has been coordinating an economic modeling exercise of the Kyoto agreement, and the participating modelers, who include academic, private sector and government analysts, have made available some of their preliminary results. Today, I will provide a brief summary of the Administration's Economic Analysis and review several of the key findings of the Energy Modeling Forum effort.

The Potential Impact of Climate Change

The Intergovernmental Panel on Climate Change (IPCC) concluded in 1995 that "the balance of evidence suggests that there is a discernible human influence on global climate." Current concentrations of greenhouse gases have reached levels well above those of preindustrial times. If growth in global emissions continues unabated, the atmospheric concentration of carbon dioxide (CO_2) will likely double relative to its preindustrial level by midway through the next century and continue to rise thereafter. As a result of the increased concentration of CO_2, the IPCC estimates that global temperatures will increase by between 2 to 6 degrees Fahrenheit in the next 100 years, with a best guess of about 3.5 degrees Fahrenheit. Potential consequences associated with this shift in climate include a rise in sea levels, greater frequency of severe weather events, shifts in agricultural growing conditions from changing weather patterns, threats to human health from increased range and incidence of diseases, changes in availability of freshwater supplies, and damage to ecosystems and biodiversity. Further discussion of the costs of climate change is contained in the Administration Economic Analysis. Please refer to the attached paper copy or http://www.whitehouse.gov/WH/New/html/kyoto.pdf for a PDF version of this document.

The Kyoto Protocol and the Buenos Aires Conference of the Parties

Previously, Undersecretary Eizenstat and I appeared before this Committee to discuss the Kyoto Protocol and the Administration's efforts to address the risks of climate change. In my testimony, I described the many important flexibility mechanisms in the Kyoto Protocol and explained how they would allow countries to achieve cost-effectively the emissions targets established in this agreement. These mechanisms, which permit what we have termed "when", "what", and "where" flexibility in meeting the Kyoto emissions targets, are described in detail in the Administration Economic Analysis. Since securing international emissions trading, the Clean Development Mechanism, and joint implementation last year in Kyoto, the Administration has worked in bilateral and multilateral arenas to promote understanding of these mechanisms and to develop rules that will promote their efficient operation. This work will continue in the talks in Buenos Aires and beyond. While I will defer to the Department of State for a discussion of the upcoming international negotiations, I will reiterate that efficient implementation of these flexibility mechanisms is critical to reducing the costs of achieving the targets established in the Kyoto Protocol.

Costs of Action

In assessing the economic effects of the Kyoto Protocol, the Administration has drawn on the insights of a wide range of models and analysis. Examples include models of the energy sector and economy over the next 25 years, such as the Stanford Energy Modeling Forum, the Intergovernmental Panel on Climate Change's review of the economic and social dimensions of climate change, the work of the Organization for Economic Co-operation and Development (OECD) on the economic dimensions and policy responses to global warming, and the Administration's staff-level interagency analysis. In addition, the Administration used other tools, such as a meta-analysis, basic economic reasoning, overviews of the domestic and international energy sectors, statistics regarding energy efficiency and greenhouse gas emissions, and economic indicators from World Bank, International Energy Agency, and Energy Information Administration databases.

Assuming that effective mechanisms for international trading, joint implementation, and the Clean Development Mechanism are established, and assuming also that the United States achieves meaningful participation of key developing countries, the Administration's overall assessment is that the economic cost of attaining the targets and timetables specified in the Kyoto Protocol will be modest for the United States in aggregate and for typical households. This conclusion is not entirely dependent upon, but is fully consistent with, formal model results. The Administration continues to believe that there are limitations to relying on any single model to assess the economic impact of the Kyoto Protocol. However, model results can further inform and improve the understanding of the effects of climate change policy. To complement the economic analysis of the Administration's policy to address climate change, we have conducted an illustrative assessment with a modified version of the Second Generation Model (SGM). The results from the SGM substantiate the conclusion that the economic effects of an efficient, effective, and global policy to address the risks of climate change will be modest.

An assessment using the SGM model that accounts for effective trading and developing country participation yields permit price estimates ranging between \$14/ton and \$23/ton, and direct resource costs to the U.S. between \$7 billion and \$12 billion/year. The range reflects uncertainty about the extent of Annex I participation in international trading.

Under the assumptions of the Administration's analysis, permit prices in the range of \$14/ton to \$23/ton translate into energy price increases at the household level between 3 and 5%. Under these permit prices, fuel oil prices would increase about 5 to 9 percent, natural gas prices about 3 to 5 percent, gasoline prices about 3 to 4 percent (or around 4 to 6 cents per gallon), and electricity prices about 3 to 4 percent. This increase in energy prices at the household level would raise the average household's energy bill in ten years by between \$70 and \$110 per year, although such predictions may not be observable because they would be small relative to typical energy price changes, and nearly fully offset by electricity price declines from Federal electricity restructuring. By 2008-2012, the anticipated 10 percent decline in electricity prices from restructuring is projected to lead to expenditure reductions of about \$90 per year for the average household.

The illustrative modeling analysis does not account for several key components of the Kyoto Protocol and the Administration's policies to reduce greenhouse gas emissions. These include the benefits of reducing net emissions through carbon sinks, the Administration's electricity restructuring proposal, the Administration's Climate Change Technology Initiative (R&D funding and tax incentives in the FY 1999 Budget), the Administration's sectoral consultations to encourage and support voluntary efforts by U.S. industry to undertake emissions reductions, including the provision of credit for early action, and the Administration's efforts to reduce federal energy use. There are also ancillary benefits of reducing greenhouse gas emissions -- in particular, the corresponding reductions in conventional air pollutants like sulfur dioxide and fine particulate matter. These benefits alone could produce savings equal to about a quarter of the costs of meeting our Kyoto target.

Since I last testified before this Committee, the Administration has released its proposed electricity restructuring legislation and the supporting analysis of this proposal. The Administration's proposed Comprehensive Electricity Competition Act (CECA) is estimated to reduce greenhouse gas emissions by about 25 to 40 million metric tons of carbon equivalent per year by 2010. Further, the electricity restructuring proposal provides potential cost-savings in four areas: dispatch efficiency, improved capital utilization, savings in capital additions and cost reductions in fuel procurement, non-fuel operation and maintenance expenses, and administrative and general expenses. These four categories of savings are likely to reach or exceed \$20 billion annually. The Department of Energy's CECA supporting analysis documents Please refer to the attached paper copy or http://www.doe.gov/ceca/ceca.htm for the PDF version of the supporting analysis. contain further discussion of the Administration's electricity restructuring proposal.

Recent Research on the Economics of Climate Change

Since I last appeared before this Committee, many economists have conducted and made available their analyses of the Kyoto Protocol. I noted in both of my previous appearances that there are limitations to relying on one or a small set of models and that we were eager to see assessments of the Kyoto Protocol by other models. In March, I indicated that the Energy Modeling Forum (EMF) based at Stanford University, a long-running model comparison exercise involving many of the leading climate and energy models, would conduct full scale analyses of the Kyoto Protocol. We have now received a compilation of the preliminary analyses by the participating modeling teams.

EMF Kyoto Analyses

The Energy Modeling Forum comparison exercise of the Kyoto Protocol has included ten modeling teams from the United States, Europe, and Asia. In evaluating the Kyoto Protocol, all of the participating teams used economic models that incorporate the potential for international trading in greenhouse gas permits. By explicitly incorporating international trading, these models can evaluate the opportunities for cost-savings through trading among Annex I nations and among Annex I and developing countries were they to adopt emissions targets. Since the Kyoto Protocol enables all countries with emissions targets to trade emissions allowances among other countries with targets, these models are well-suited to assess the economic implications of the international trading component of the agreement.

While the EMF models can assess international trading, there are several other flexibility mechanisms of the Kyoto Protocol that they cannot, at present, readily assess. For example, these models did not incorporate the effects of sinks. While several modelers did assess the economic costs of achieving the Kyoto targets with “off-line” assumptions about sink activity, none incorporated an integrated energy-land use model. Further, most of the modelers did not evaluate opportunities to reduce costs by trading across greenhouse gases. These models are primarily energy models and are focused on the economics of reducing carbon emissions from fossil fuel combustion. Again, some modelers analyzed the Protocol by making some “off-line” assumptions about the potential reductions in non-carbon dioxide greenhouse gases, but none employed a model with cost curves for these gases. Finally, it should be noted that these models did not include opportunities for emissions reduction through Administration proposals, such as electricity restructuring or the Climate Change Technology Initiative, that could lower greenhouse gas permit prices.

The EMF results provide very useful context for the Administration’s economic analysis. First, the illustrative model used by the Administration, the Second Generation Model of the Pacific Northwest National Laboratory, tends to fall in the middle of the range of this set of models in terms of U.S. permit prices. Please note that the version of SGM used in EMF differs from the analysis conducted by the Administration because the EMF version does not include cost curves for non-carbon dioxide greenhouse gases used by the Administration. Since efficient trading across gases would lower costs and permit prices, the EMF version of SGM yields slightly higher permit prices than the Administration version. For example, under Annex I trading SGM generates a permit price which is at the median of this set of models. Under full global trading, the SGM permit price is just below the median permit price. Second, the EMF exercise found that the reduction in permit prices as trading expands from no trading to Annex I trading to full global trading is robust. On average, the EMF models found that Annex I trading would cut the U.S. permit price by 53% relative to a no trading scenario. Of these models, one estimated a 72% reduction in the permit price under Annex I trading. In full global trading, the permit price would be, on average, 80% lower than the no trading price. Several models estimated permit price reductions of about 90%.

Analyses of Trading Constraints

In addition to the modeling of various efficient international trading scenarios, several EMF modeling teams have considered the impact of constraints on the opportunity to buy or sell emissions allowances in an international market. While the United States is unambiguously opposed to trading restrictions, several parties to the agreement have indicated support for some form of a trading constraint, for example, by setting a limit on the amount a party can purchase through the trading system. Trading restrictions would generate no benefit for the global climate while they could significantly increase the costs of achieving the Kyoto targets.

Before describing the economic costs of trading constraints, I would like to explain why such constraints yield no climate benefits. Regardless of where an emission reduction occurs, it has the same effect on total emissions and the same effect on the climate. A ton reduced in New York generates the same climate benefit as a ton reduced in Berlin. In proposing trading constraints, some have focused on countries such as Russia, that will have emissions below their Kyoto targets during the commitment period because of the decline in their economic output associated with the transition to market economies. If trading constraints are established that restrict the ability of Russia to sell permits (or restrict the opportunity for other Annex I countries to buy Russian permits), then emissions during the first commitment period would be lower than in the absence of such constraints. However, Russia would simply bank its allowances and use these allowances in a subsequent commitment period when its emissions exceed its target. While a trading constraint might lower emissions during the first commitment period, the cumulative emissions over several commitment periods from Annex I countries would be the same with and without the trading constraint. Given the long residence times of greenhouse gases (on the order of a 100 or more years), the cumulative effect is what is most relevant in terms of changes in the global climate.

To provide a sense of the economic implications of trading constraints, I would like to share with you two examples from work done by EMF modeling teams. First, consider a trading constraint that mandates that at least two-thirds of the emissions reductions necessary for a country to achieve its Kyoto target must occur through domestic actions. Evaluating this trading constraint with the EPPA model based at the Massachusetts Institute of Technology, the permit price for the United States is almost four times higher with the constraint than under an unconstrained global trading system. It is important to note that the effects of this constraint are even more pronounced for the European Union and for Japan. The permit price for the EU would be more than five times higher than the unconstrained global trading permit price, and the Japanese permit price would be thirteen times higher. As these results indicate, the trading constraint would result in each country experiencing a different marginal cost of abatement, and there would be no common permit price for a ton of carbon equivalent. Since the constraint restricts opportunities for countries like the United States, Japan, and members of the EU to buy emissions allowances, the competitive price for emission allowances from countries like Russia would fall below the unconstrained level.

Second, consider a trading constraint that mandates that acquisitions of permits through international trading could not exceed 10% of a country's emissions allocation. For example, the U.S. target is approximately 1.5 billion tons of carbon equivalent on an annualized basis. Under this trading constraint, the United States, or private firms in the United States, could not purchase more than 150 million tons on an annual basis from other countries. Assessing this trading constraint with the Second Generation Model based at the Pacific Northwest National Laboratory, the permit price for the United States would more than triple relative to the unconstrained global trading permit price. For the EU, the permit price would nearly double, and for Japan, the permit price would be eleven times as high as the unconstrained global price.

While trading constraints increase greenhouse gas permit prices (and subsequently, energy prices) in the United States, the European Union, and Japan, they also reduce the gains from trade by the countries likely to be sellers of emissions allowances. For example, Russia and large developing countries that adopt emissions growth targets and participate in international trading, e.g., China and India, would sell fewer emissions allowances at lower international permit prices under such trading constraints than in an unconstrained global trading environment. Such restrictions lessen the benefits of participation by developing countries in international trading.

Developing Country Participation

While no non-Annex I country has yet adopted a binding emissions target, economic and environmental benefits would accrue if some developing countries do so. Setting a target below the business as usual emissions level for the commitment period would generate climate benefits by reducing global emissions below what they would otherwise have been. In addition, if the target is set not too far below the business as usual emissions level, the participation of the country in a global trading system would produce economic benefits or "gains from trade" for both the developing country and its trading partners. Emissions trading by developing countries would occur only if they chose to undertake emissions reductions above and beyond their commitments -- reductions that would generate trading extra income for them as long as their marginal abatement cost is below the world trading price for greenhouse gas permits. Many of the EMF models reveal that, for large developing countries, like China, such excess reductions would indeed be profitable, so that these countries would export allowances and gain from trade. Developing countries would also reap ancillary benefits of reducing conventional air pollutants, which may be substantial. Benefits from trading would also accrue to Annex I countries. Annex I countries (and private firms in these countries), who would purchase these emissions allowances in the world market, would achieve their targets at lower cost than without the participation of the developing countries. However, it should be noted that the more stringent the target for the developing country, the lower the gains from trade both for that country and for Annex I countries such as the United States. Indeed, an extremely stringent target could conceivably make the developing country a net importer of emissions allowances, and raise the international trading price for a greenhouse gas permit. Still, these models illustrate the potential to create targets that simultaneously make the environment, the developing country, and Annex I countries all better off.

Conclusion

The Administration's overall conclusion is that the economic impact of the Protocol will be modest under the conditions we have identified in our economic analysis. The purpose of this testimony has been to summarize the analysis we have presented in the Administration Economic Analysis on climate change and to provide a brief update of recent modeling efforts outside of the government.

I look forward to continuing to work with members of this Committee, as well as with other interested parties, in further analyzing the Kyoto Protocol and evaluating the net effects of reducing greenhouse gas emissions. It is my hope that economic analysis will continue to play a key role in designing policies in this area.

I welcome your questions.

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U.S. Department of State
Testimony Before the House Commerce Committee,
Subcommittee on Energy and Power
Washington, DC, October 6, 1998

Buenos Aires Climate Change Meeting: Status of Negotiations

Introduction

Thank you, Mr. Chairman and members of the subcommittee.

I am pleased to be with you today to discuss the current status of negotiations leading to the next meeting of the Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC) to be held in Buenos Aires, Argentina this November. I will also highlight our ongoing, intensive diplomatic efforts in this regard. Almost one year ago, the world community took an historic step forward in its efforts to address climate change in adopting the Kyoto Protocol to the UNFCCC. I will not go into detail regarding its many substantial elements with which I'm sure you are familiar — five-year commitment periods, the flexibility mechanisms (i.e., emissions trading, joint implementation and the Clean Development Mechanism), and inclusion of all six major greenhouse gases and sinks. Suffice to say that we believe the Protocol represents an important milestone on the path toward putting in place a credible global response to this significant environmental problem.

That said, the Protocol is a "work in progress." We still need to elaborate the Protocol's provisions for flexibility mechanisms to assure that they are cost-effective tools and are not unduly burdened with bureaucratic structure or artificial constraints, and we continue to pursue securing meaningful participation by key developing countries. The Clean Development Mechanism (CDM) will likely be pivotal to encouraging developing countries to engage in the global response to climate change. The CDM will do so by example and incentive — by showing how actions to limit, reduce or sequester greenhouse gas emissions also bring significant benefits in promoting technology transfer, increasing the availability of financial resources and promoting sustainable development. Moreover, there is much we can do bilaterally to build capacity in developing countries to address this challenge.

We recognize that we have not yet achieved the meaningful participation by key developing countries to which the President is committed. I would like to reiterate our intention to obtain such participation prior to submitting this agreement to the Senate for its advice and consent.

U.S. Commitments Under the UN Framework Convention on Climate Change

As we look to Buenos Aires, our goal is to make progress on our climate change agenda. We must not lose sight of the instrument that is in force — the 1992 UN Framework Convention on Climate Change (UNFCCC). There are commitments under this treaty that will be reviewed in Buenos Aires and subsequent Conferences of the Parties to the UNFCCC — and the more we progress on meeting these commitments, the better prepared Parties will be to address the goals of the Kyoto Protocol when it is complete and in force. Since 1992, when the United States was the fourth nation in the world and the first developed nation to ratify, 175 countries have become Parties to this Convention to combat global warming.

From the beginning, the United States spearheaded the international effort to address climate change. Ten years ago, the Reagan Administration supported the establishment of the Intergovernmental Panel on Climate Change (IPCC), which just held its fourteenth meeting and launched its Third Assessment Report on climate change. The initial work of the IPCC prompted the Bush Administration to join the international call to establish a negotiating body to deal with this issue. In 1991, the U.S. hosted the first meeting of the Intergovernmental Negotiating Committee (INC), whose hard work culminated in the adoption of the Convention in May 1992. The INC met six times over two years to craft an historic agreement. President Bush signed the Convention at Rio in June 1992 and promptly submitted it for the Senate's advice and consent. Later that year, in bipartisan fashion, the Senate gave its support to the treaty without opposition. The Convention entered into force in March 1994.

Let me briefly review the commitments that the United States undertook in becoming a Party to the Convention. The ultimate objective of the UNFCCC is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous, human interference with the climate system. To this end, the UNFCCC established implementation and technical bodies, set forth binding commitments for all Parties, and called for periodic review and updating of obligations. All Parties, including developing countries, are obligated, among other things, to:

— Prepare national inventories of greenhouse gas (GHG) sources and sinks;
— Formulate and implement national programs containing measures to mitigate climate change;
— Report information related to the implementation of obligations; and
— Promote and cooperate in education, training and public awareness related to climate change.

Furthermore, Parties listed in Annex I, including the United States, agreed to:

— A continuing obligation to adopt policies and measures and take corresponding measures to address climate change through both limitation of emissions and enhancement of sinks;
— Enhanced reporting obligations; and
— A non-binding "aim" of returning their net GHG emissions to 1990 levels by the year 2000.

U.S. Fulfillment of Its UNFCCC Obligations and Aim: Climate Change Action Plan and October 1997 Initiative

All of our existing and proposed domestic climate change initiatives further the fulfillment of U.S. obligations under the Climate Convention to adopt policies and take corresponding measures to limit greenhouse gas emissions. These are in no way an attempt to implement the Kyoto Protocol before it is ratified. Rather, these actions are consistent with our existing treaty obligations. The United States is, thus, taking steps to implement existing commitments while it continues to complete work on the Protocol. Because the United States is the biggest emitter in the world, the level of our commitment to address climate change sends a clear signal to all nations. To the extent that the United States can demonstrate continued leadership through serious domestic action, the U.S. position is strengthened in the international negotiations. Without such dedication, it would be difficult to sustain U.S. leadership on the climate change issue.

Climate Change Action Plan

The Climate Change Action Plan (the Action Plan), announced by President Clinton and Vice President Gore in October 1993, is designed to promote environmentally sound economic growth in the United States into the next century — and help mitigate the threat of climate change. The Action Plan is also designed to generate sustainable emission reductions that increase over time, providing larger benefits in later years.

The Action Plan consists of over 40 programs that combine efforts of the public sector (federal, state, and local governments) and the private sector through a number of different approaches. These programs reduce emissions while stimulating greater energy efficiency, and commercializing renewable energy technologies. Through the Action Plan programs, the United States is:

— Preserving the Environment: The Action Plan comprehensively addresses all major greenhouse gases in all sectors of the economy. It provides additional environmental co-benefits, including preventing ozone and particulate air pollution and reducing solid and hazardous wastes.

— Contributing to Economic Growth: The Action Plan contributes to improving productivity and economic growth, and generates employment opportunities by promoting the use of advanced technologies and eliminating unnecessary energy expenditures.

— Building Partnerships: The Action Plan relies largely on successful voluntary approaches to engage U.S. businesses in achieving greenhouse gas reductions.

— Involving the Public: Federal agencies solicited outside views when developing the Action Plan and this evaluation — and the public contributes continually to the development and improvement of Action Plan programs.

- Encouraging International Emission Reductions: Recognizing the significant potential for cost-effective emission reductions in other countries, the Action Plan established the U.S. Initiative for Joint Implementation and the U.S. Country Studies Program. Many of the Action Plan programs are assisting other countries in achieving cost-effective emission reductions.

Many Action Plan programs have been highly successful. The Action Plan has over 5,000 organizations participating from around the country. As recognized in the Action Plan, it will take most of the programs three to five years to begin to achieve substantial carbon reduction benefits based on the strong foundations and partnerships that have been built. Here are some of its many successes:

- Thousands of efficient ENERGY STAR-labeled products are widely available.
- Over 2,300 partners in the ENERGY STAR Buildings and Green Lights programs have invested over $1 billion in energy-efficient improvements, saving over $250 million on their energy bills in 1996 alone.
- Rebuild America is reducing the $6.5 billion energy bill at colleges and universities across the country.
- USDA programs have led to the planting of trees on 54,000 hectares of land.
- In 1996, partners in EPA's Natural Gas STAR program reduced methane leakage from natural gas pipelines by over 1.0 million metric tons of carbon equivalent.

October 1997 Initiative

In October 1997, well before Kyoto, President Clinton outlined an environmentally and economically sound plan for reducing U.S. greenhouse gas emissions, which is fully consistent with U.S. obligations under the UNFCCC and designed to meet the voluntary "aim" and other ongoing commitments. The plan encompasses ground-breaking initiatives designed to cut emissions by increasing energy efficiency; developing and encouraging diffusion of new, cleaner energy technologies; working with industry and others to promote sensible solutions to the climate change problem; and employing market-based mechanisms to ensure cost-effective reductions. By promoting technology development and diffusion now, we will be increasing our competitiveness and we will be making a down payment that can help us avoid potentially costly actions in the future.

Specifically, the President's plan includes the Climate Change Technology Initiative — an ambitious program of tax cuts and funding for research and development aimed at improving energy efficiency and spurring the use of renewable energy sources. Included in the President's FY 1999 budget, the package amounts to $6.3 billion over five years, $3.6 billion in tax cuts and $2.7 billion in new investment. Electricity restructuring and efforts to improve energy use and procurement practices by the federal government will also help reduce emissions. On a longer time horizon, a domestic emissions trading system will be developed and in place by 2008.

An important component involves building partnerships with key energy-intensive industries to develop sector-by-sector initiatives to cut emissions. These partnerships will identify opportunities for working together to remove barriers to the development and widespread use of energy efficient technologies and practices. One example is the Partnership for Advancing Technology in Housing (PATH) which will also play an important role in achieving the goals of the President's plan. As part of its consultations, the Administration will discuss ways to ensure credit for businesses that act early. High-level Administration officials have already met with CEOs from the steel, aluminum, cement, publicly owned and investor-owned electric utilities, forest products and gas pipelines industries.

Expectations for Buenos Aires

In the context of six years since the Framework Convention on Climate Change was opened for signature and the recently negotiated Kyoto Protocol, the fourth meeting of the Conference of the Parties to the UNFCCC (COP-4) provides an opportunity to continue momentum on both of these historic agreements. Breakthrough accomplishments and headline-making events, however, are not likely, given the early stage of international understanding of how the flexibility mechanisms in the Protocol can work. We are focused on achieving "maximum progress" as we seek to advance the ultimate objective of the Convention and to elaborate upon the unfinished business of Kyoto.

We believe all countries, both developed and developing, should reiterate the need for concerted, cooperative action to address this global problem. We intend to renew our commitment to taking actions in the context of the Framework Convention, which recognizes the need for a global effort. And, we hope others will do the same.

The problem of climate change emerged over decades and solving it is a "marathon" not a "sprint." We view COP-4 as a stepping stone to future efforts on climate change, and as such, it must yield incremental, but credible progress.

Flexibility Mechanisms

Our assessment three weeks before the international community convenes in Buenos Aires is that there is a solid basis for making progress on elaborating the Kyoto Protocol's flexibility mechanisms — emissions trading, joint implementation, and the Clean Development Mechanism (CDM). Securing agreement on rules and guidelines is essential to protect U.S. interests and achieve the objectives of Kyoto. The U.S. was able to agree to the Protocol, in large part, because these mechanisms were included. Moving "the ball forward" at Buenos Aires on verification, measurement and reporting rules and guidelines would be a welcome development. Our goal is to engage in frank discussions on the areas of shared interest, to develop a consensus on next steps, and to avoid unproductive arguments on issues than cannot be resolved at COP-4.

Essentially, there is agreement on the need to strike a balance between ensuring the integrity of the international emissions trading system through strong rules, and maximizing its ability to generate emissions reductions worldwide by making it simple, credible and transparent. Trading is a complex issue and countries have different views on precisely how it should work. We are working with other nations to improve decision makers' understanding of the mechanics as well as their comprehension of our positions. Above all, we need to ensure that emissions trading, as well as the other flexibility mechanisms, are cost-effective and environmentally sound. Progress on this front with the European Union at the recent informal Ministerial in Tokyo seems to have reduced the likelihood that this issue of the flexibility mechanisms will be divisive at COP-4.

The Clean Development Mechanism, or CDM, shows real promise as a bridge between the developed and developing countries in their efforts to address the global problem of climate change. As with the other mechanisms, familiarity with the fundamentals of the CDM is moving us closer to agreement on next steps. More Parties accept that the projects to be covered by the CDM can create emissions reductions that translate into global environmental benefits, ensuring that investments in developing countries further sustainable development, while helping developed countries meet their Kyoto goals, cost-effectively, through applying project-generated credits against their targets.

One positive outcome of COP-4 would be a work plan and timetable for further elaboration of the rules, modalities and guidelines for all of the flexibility mechanisms. Such a plan would signal that we are moving forward, and that we understand the need for greater certainty among our public and private sectors about how the Kyoto mechanisms and processes will work. We have been engaging in efforts to seek input from financial experts and U.S. industry on aspects of emissions trading and other market mechanisms to inform our policy formation on such issues as allocation of risk and institutional structures, and we will continue to do so as these issues will need further refinement after Buenos Aires.

COP-4 offers an opportunity to share perspectives on how to proceed and build consensus on concrete steps that can be taken to reduce the growth in greenhouse gas emissions without jeopardizing economic growth. We plan to share experiences gained through the "Activities Implemented Jointly" pilot phase, as well as highlight successful domestic policies and measures that may have lessons for others.

Engaging Developing Countries

We continue to make clear, at every opportunity, that developing countries must be part of the solution to the climate change problem. Meaningful participation by key developing countries is essential. In evaluating what constitutes this level of participation, it is important to keep in mind the substantial differences that exist among developing countries in terms of their emissions profiles, levels of development, capacity for effective action, and economic and political conditions. We have not established a fixed standard or set of criteria. Instead, we want to convey that key developing countries must commit to serious steps to limit their greenhouse gas emissions and help in the international effort to control global warming. This could effectively be accomplished through developing countries' taking on their own emissions targets, consistent with economic growth, which would enable them to participate in international emissions trading. At the same time, we do not believe that it makes good sense to rule out other potential ideas for accomplishing the desired result, namely that key developing countries take serious steps to limit their emissions. We also believe that active participation in the Clean Development Mechanism could be a factor in determining meaningful participation.

At COP-4, we anticipate that the issue of developing country participation will be extensively discussed. COP-4 will provide an opportunity to advance the ongoing dialogue on the need for greater developing country involvement and the meaningful participation of key nations. We also expect important discussions on the Clean Development Mechanism, as noted earlier, and on ways that non-Annex I Parties can more fully achieve their existing Climate Convention commitments.

Technical Issues

Meeting only once a year, the COP must take up a number of technical issues that often do not receive as much attention as the others I have mentioned. An example of this is land use change and forestry, more commonly referred to as "sinks." Because of the linkages to the Kyoto Protocol, the COP will seek to continue to increase understanding of the concepts found in Article 3, including those recently addressed at a joint workshop sponsored by the Intergovernmental Panel on Climate Change (IPCC) and the Subsidiary Body for Scientific and Technological Advice (SBSTA) under the Convention — afforestation, reforestation and deforestation. The outcomes of the workshop — an outline for an IPCC Special Report on land use change and forestry and suggestions for authors — were forwarded to the full IPCC Plenary which met a few days ago in Vienna and agreed on a final outline for this Special Report that should be available in early 2000. A second workshop will be held in the United States early next year to consider the additional categories of sinks in Article 3.4 of the Protocol.

A second important "technical" issue is that of reporting obligations under the UNFCCC. The Parties will consider how Annex I Parties are to begin preparing for the submission of their third national communications by addressing timing and guideline questions. Because these reports will contain emissions inventory data as well as description of policies and measures, they will be critical indicators of progress in the post-2000 period. The Parties will also agree upon the process for considering the first communications from non-Annex I Parties. Such a process will enable all Parties to determine how these Parties are fulfilling their Convention obligations, to what extent they are taking measures to mitigate climate change, and what further assistance they may need.

Bilateral and Multilateral Activities: Advancing U.S. Climate Change Diplomacy

Since Kyoto, the State Department and other U.S. government agencies have been hard at work to further U.S. objectives through a "full court" diplomatic press in a variety of multilateral and bilateral discussions. At the highest levels, President Clinton and Vice President Gore have raised climate change in their meetings with the leaders of China, Korea, and other countries in Europe, Latin America and Africa. Secretary Albright has also taken advantage of every opportunity in many of these and other countries to urge other nations to support our positions on the flexibility mechanisms and securing meaningful participation by key developing countries.

Under Secretary of State Stuart E. Eizenstat led our delegation to an informal Ministerial on Climate Change held in Tokyo on September 17-18. Among the approximately twenty countries invited to attend, there was a strong spirit of cooperation and shared commitment to continue the progress on climate change begun in Kyoto last December. The Ministerial focused on the critical COP-4 issues that I have outlined, especially emissions trading. One week later, I led the U.S. delegation to a ministerial on the Clean Development Mechanism, co-hosted by the Canadian, Brazilian and Argentine governments. The meeting sought to inform ministers and other high-level officials on technical issues of the CDM and its potential to facilitate the transfer of technology and investment opportunities in developing countries. I believe it also enhanced the cooperative spirit between developed and developing countries on this important flexibility mechanism. Both meetings, and others, provided excellent occasions to have bilateral discussions with a number of delegations including those from Argentina, Brazil, China, and Samoa.

Most recently, I was in London last Friday meeting with my G-8 counterparts to discuss our respective views on the flexibility mechanisms, developing country participation, and other issues that will arise in Buenos Aires. A great deal of effort centered on convincing our European partners of the necessity of an unfettered emissions trading system, built on a foundation of credible reporting, measurement and verification. We are awaiting developments in Luxembourg this week as the EU Environment Ministers formulate positions for COP-4.

Within the last month, I have also traveled to China, Korea, Japan and Canada to advance our climate change goals. In early September, I led an interagency delegation to China, in fulfillment of an agreement reached at the Clinton-Jiang Presidential Summit. We had very productive discussions with a number of ministries to identify areas of cooperation between our nations. We were encouraged by the positive atmosphere of the talks and their usefulness in sharing views and perspectives. In Seoul, we met with Korean government officials and explored how to advance full acceptance of the flexibility mechanisms and offered technical bilateral cooperation on energy efficiency and conservation, assessment of reduced reliance on fossil fuels, and other related environmental issues, including the identification and evaluation of ancillary health benefits. In virtually every instance, we have explored how developing countries could assume commitments consistent with their economic and environmental objectives, particularly in light of the flexibility mechanisms.

In addition to these extremely useful sessions, the "Umbrella" group (a group of countries with common views on many of the flexibility mechanisms, and including the U.S., Japan, Canada, Australia, New Zealand, Norway, Iceland, the Russian Federation, and Ukraine) held meetings in Wellington, New Zealand, September 7-8. Participants from eight of the nine Umbrella partners (Ukraine was not able to attend) met to discuss issues related to emissions trading including allocation of risk in transactions and institutional structures. In addition to agreement to continue our close, collaborative efforts, the Umbrella group reached consensus on responses to questions on the flexibility mechanisms posed by the developing countries at the June meetings of the UNFCCC Subsidiary Bodies. Ukraine's concurrence to the responses was gained through off-line conversations at the meeting of the OECD/IEA Annex I Experts Group in Paris, which immediately followed the Umbrella session. At that meeting, we had an opportunity to discuss international emissions trading at some length. We understand that papers informed by the discussion at the Paris meeting are being prepared by the OECD for COP-4. With regard to Ukraine, a State Department-led delegation is meeting with officials in Kiev this week to enhance their understanding of emissions trading through a workshop and to conduct general climate change bilaterals.

Next Steps: Three Weeks to COP-4

In the coming weeks, the Administration, the Department and other agencies will be fine-tuning our negotiating position for Buenos Aires and working to build alliances with partners on the whole suite of issues. We intend to utilize every opportunity to convey our position and seek support for our views on the flexibility mechanisms, developing countries, and the technical issues. We look forward to your participation in the Buenos Aires meeting, and to working with you as we seek to address this critical problem.

Mr. Chairman, members of the subcommittee, thank you for your attention. I would be pleased to respond to any questions that you might have.

Stuart E. Eizenstat
Under Secretary for Economic, Business, and Agricultural Affairs
U.S. Department of State
Speech at the Center for National Policy
Washington, DC, October 28, 1998

Fighting Global Warming: From Kyoto to Buenos Aires and Beyond

As Prepared For Delivery

Good morning. I am especially pleased to be at the Center for National Policy. I was present at its creation and involved in its initiation, served on its Board for many years, and became a great admirer of Mo Steinbruner, the Center's talented President. I want to talk about the progress the Administration has made on climate change, and what we hope to accomplish at the upcoming negotiations in Buenos Aires. I had the privilege of heading the U.S. team in Kyoto, and will do so again in Buenos Aires. We have a fine team of experts working on this issue. It shows in the tremendous progress we have made towards achieving an international approach that can insure at a reasonable cost against the potential damage of climate change.

In just under a year since some 160 countries reached the historic Kyoto agreement on climate change at the third Conference of the Parties (COP3), we have made significant progress on multiple fronts. We look to COP4 in Buenos Aires not as a place for spectacular diplomatic breakthroughs as we accomplished in Kyoto, but as a significant milestone in efforts to consolidate our gains and to make concrete and operational our Kyoto achievements.

Kyoto Accomplishments

Kyoto was a genuine breakthrough. For the first time markets will be put to work to help international efforts to address an environmental problem -- climate change, the most profound environmental challenge of the 21st century. International action was taken in response to powerful scientific consensus that global warming is indeed occurring, and that the cause is greenhouse gas emissions related to human activity. In Kyoto, industrialized countries took on binding targets to cut aggregate emissions by 5.2% below 1990 levels.

The Protocol reflects the environmentally and economically sound approach of the United States. It is strong and realistic; it is market-based and flexible. As the U.S. called for, the Protocol established a commitment period of 2008 to 2012, which gives us start-up time to adjust and a five-year period over which to achieve our emissions reduction goal. As we wanted, the Kyoto agreement also provided similar but differentiated targets among developed countries to allow for varying economic profiles and levels of industrialization. We achieved the inclusion of all six gases that contribute to the problem, over the objections of the European Union and Japan. The United States also pressed successfully for coverage of carbon "sinks" in the Protocol, knowing that agriculture and forestry practices can help reduce carbon in the atmosphere and should be recognized as a tool in fighting global warming.

Perhaps the greatest achievement at Kyoto was the inclusion of the market-based, flexibility mechanisms we championed to supplement domestic measures to reduce greenhouse gas emissions. These mechanisms provide the flexibility and incentives to help us find the least-cost reductions worldwide to achieve Kyoto's overall emissions target. The flexibility mechanisms include international emissions trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI).

Emissions trading enables those countries with binding emissions targets to participate in an international market that for the first time gives explicit value to emissions reductions. If the cost of abatement in a given country is low by world standards, and that country is therefore able to get below its emissions target, it would have allowances to sell to those countries where abatement costs are relatively high. Both a seller and a buyer willing to pay for the allowance would have to play by the rules.

Kyoto's Clean Development Mechanism involves voluntary, project-based investments by developed countries and their firms in developing countries. These would be win-win investments. Countries with binding emissions targets would get credit toward their targets for making beneficial investments in developing countries that provide capital and clean technology. Developing countries would get world-class technology as developed countries act to meet their targets. Joint Implementation allows developed country investors to share efforts on environment-friendly projects that limit emissions, and to share credit for the results against their emissions targets.

The Administration's economic analysis underscores the importance of trading in achieving emissions reductions agreed at Kyoto cost-effectively. It shows that an effective international market for trading emissions allowances among industrialized countries alone could dramatically lower the resource cost to the United States. At the same time, making agreed reductions in greenhouse gases would help the United States avoid the damage of climate change, which some estimates place in the billions of dollars annually, and enjoy related health and other benefits. Moderate estimates of the economic cost of meeting the Kyoto targets assume implementation of the very flexibility mechanisms for which we fought at Kyoto, and now work to make a reality.

The Kyoto framework reflects the view that climate change is a serious, global environmental problem which must be addressed at the lowest cost to the world economy, and experience that it can be done without a large bureaucracy, overly-intrusive regulation, or high taxes. The trading system used in our domestic SO_2 program to reduce acid rain, for example, has achieved our environmental goals at just 50 percent of initial cost estimates. Despite the complexity of making Kyoto's provisions operational, and of building confidence in the international community that we can make them work to the benefit of all, much has happened in the last year to make this task all the more urgent.

It is becoming harder for skeptics to contest the science. Significant new findings over the past year reinforce the broad, scientific consensus that human activities are disrupting the Earth's climate. New analyses of tree ring, ice melt, borehole, and satellite data provide further evidence that global temperatures are rising as a result of increasing concentrations of greenhouse gases. Following 1997, the hottest year on record, the first nine months of 1998 have been even hotter. This year's extreme weather events have been of historic proportion and devastating cost -- from raging fires in Indonesia, the Amazon, Florida, and Mexico, to drought in Texas followed by life-threatening floods, and floods in China and Bangladesh that left tens of thousands homeless, hungry, and sick. These events are a window on what the Earth may be like with global warming.

Progress This Year

The past year has also seen tremendous progress in our fight against global warming. First, we have stepped up our domestic efforts. Since ratifying the original climate change treaty in 1992, the United States has put more than 50 domestic programs in place to help address the problem. There should be no doubt about our commitment to aggressive, domestic action. In just-completed budget negotiations, the Clinton Administration secured a 25 percent increase in investments against climate change -- in energy efficiency, renewables, and R&D – with resources now totaling some $1 billion for FY1999. These funds will go to a wide array of programs such as the Partnership for the Next Generation Vehicle, where we expect to see new U.S. cars in production early in the next decade with triple the gas mileage of today's cars, and the Partnership for Advancing Technology in Housing, or PATH, which will make new housing up to 50 percent more energy efficient. In addition, the Administration's electricity restructuring plan will increase efficiency, spur renewables, and help cut emissions as well.

The Administration will come back with a request for more in the FY2000 budget, including added emphasis on incentives for farmers and others to explore opportunities in biofuels and to identify how land use practices can help clean carbon from the air. These are promising areas through which our agriculture and forestry sectors may well benefit from our efforts against global warming.

Second, the Administration has undertaken intensive consultations and mutual education efforts with business, agriculture, and other citizens groups. We have successful discussions with industry groups to improve energy efficiency and cut emissions. Credit for early action on climate change is high on their list of priorities and on ours, so we welcome the bipartisan legislation on this issue recently introduced by Senators Chaffee, Liebermann, and Mack. Industry is taking active steps already. Important companies such as IBM, Sunoco, British Petroleum, Shell, United Technologies, and Intel have recently committed to reduce significantly their greenhouse gas emissions. BP is putting in place an internal trading system designed to keep the cost of meeting this goal as low as possible. A number of these firms plan to start trading emissions amongst themselves as well to cut the cost of planned reductions. We will be very interested in the results of these innovative efforts.

Third, over the last year, we have also mounted a comprehensive diplomatic effort to encourage developing countries to become meaningfully involved in limiting the increase in their emissions, consistent with needed growth. While we intend to sign the Protocol to help lock in the gains made at Kyoto, the President has indicated he will not submit the Kyoto Protocol for advice and consent by the Senate without meaningful participation by key developing countries. Many developing countries remain resistant to emissions targets, and mistrust the flexibility mechanisms. But our discussions with them have become more regular, substantive, and detailed, and they are becoming aware of their potential vulnerability to climate change and of the benefits of taking action.

We are engaged with dozens of developing countries through our bilateral assistance programs to encourage them to take steps toward sustainable development. With $193 million appropriated for the Global Environmental Facility in this year's budget talks to cover U.S. arrears, the Facility should be able to complement some of these efforts through their climate-related programs.

Developing Countries

In our approach to developing countries, we find it helpful to group them into several categories. This recognizes the substantial differences among them in terms of emissions profiles, levels of development, capacity for effective action, and economic and political conditions. One category of developing countries combines relatively high-income developing and newly industrialized countries. This includes new members of the OECD and those nations that aspire to OECD membership. We have not only pressed hard bilaterally for their participation, but have achieved the backing of other countries to urge them to take on binding growth targets to limit the rate of increase in their emissions.

In another category are large emitters with low incomes. None of these countries to date has indicated a willingness to take on quantitative targets. We have engaged vigorously with them at the highest levels and will continue to do so. The United States now has in place a high-level dialogue with China, for example, through which we have stressed the potential impacts of climate change on China as well as the health, energy efficiency, and other benefits of early action.

There is another, mixed category of middle-income countries of varying sizes and emissions levels. We see particular opportunities in Latin American and the Caribbean. Argentina, as chair of the COP4 meeting, is an important leader in this process. Brazil introduced the Clean Development Mechanism at Kyoto, and has led on renewable energy and alternative fuel strategies in the region. We have had setbacks in our progress with other middle-income countries in Asia due to recent economic events, but we continue to work with them bilaterally and multilaterally.

Finally, there is a sizeable category of poor countries with low emissions and low incomes. Although climate change often poses serious potential threats to them, they have limited capacity to undertake the kinds of actions and commitments that we expect of countries with more advanced economies. These include, for example, most of sub-Saharan Africa. We are working with such countries to build their capacity to participate in solving the global problem of climate change. The small island states that are uniquely vulnerable to climate change also offer opportunities for cooperative activities.

Buenos Aires and Beyond

At Kyoto we created the architectural structure of international efforts to address climate change. We hope Buenos Aires will create a process for installing the interior plumbing and circuitry to make Kyoto a reality.

First, in Buenos Aires we will oppose any backsliding on the grand bargain that was struck in Kyoto. At Kyoto, we joined others in taking on a strong emissions reduction target. We did it with the clear understanding that, like the European countries have done with their Bubble, we would be able to use the flexible, market-based Kyoto mechanisms without arbitrary limits to meet our obligations cost-effectively. That agreement must hold.

We have formed a successful alliance since Kyoto with eight other like-minded countries -- (including Canada, Japan and Russia) the "Umbrella Group" -- to develop common positions on Kyoto's flexibility mechanisms. With us they strongly oppose efforts by the EU countries to restrict the legitimate use of emissions trading and the other agreed flexibility mechanisms.

There should be no limit on how much the United States can do at home -- and we are making aggressive efforts -- but neither can there be a limit on what we can accomplish through agreed flexible mechanisms. We will resolutely oppose efforts to set arbitrary limits on trading. They would impose unsustainable costs on the U.S. economy and actually discourage deeper reductions in greenhouse gas emissions.

Second, we will stress that Buenos Aires should avoid divisive polemics regarding caps on the flexibility mechanisms and concentrate instead on Buenos Aires initiatives to develop a work plan and a working group process, with clear timetables for elaborating the rules for trading and the other market mechanisms. This is urgent if we are to make sufficient progress to have the CDM up and running by 2000 as the Protocol provides. At the same time, the rules must not entail too much red tape or excessive bureaucracy. The Buenos Aires work plan must also recognize the need to develop appropriate mechanisms for measurement, reporting, and compliance in a system with high standards.

Third, progress on developing country participation must also be made at Buenos Aires; we cannot solve the problem without them. We will hold intensive bilateral and multilateral discussions directly with developing countries and work to build the momentum for action. We will encourage discussion of these issues among the Parties in Buenos Aires.

November's international negotiations on climate change in Buenos Aires will not have the glamour and novelty of Kyoto. But they can advance the tough work needed to make Kyoto's remarkable promise a reality. We hope to get beyond rhetoric and ideology and shape the tools needed to get the job done for the benefit of all.

Thank you.

Administration Fact Sheets

The Kyoto Protocol on Climate Change

Fact Sheet released by the Bureau of Oceans and
International Environmental and Scientific Affairs
January 15, 1998

BACKGROUND

At a conference held December 1 - 11, 1997, in Kyoto, Japan, the Parties to the UN Framework Convention on Climate Change agreed to an historic Protocol to reduce greenhouse gas emissions by harnessing the forces of the global marketplace to protect the environment.

The Kyoto Protocol in key respects — including emissions targets and timetables for industrialized nations and market-based measures for meeting those targets — reflects proposals advanced by the United States. The Protocol makes a down payment on the meaningful participation of developing countries, but more needs to be done in this area. Securing meaningful developing country participation remains a core U.S. goal.

EMISSIONS TARGETS

A central feature of the Kyoto Protocol is a set of binding emissions targets for developed nations. The specific limits vary from country to country, though those for the key industrial powers of the European Union, Japan, and the United States are similar — 8% below 1990 emissions levels for the EU, 7% for the U.S., 6% for Japan.

The framework for these emissions targets is based largely on U.S. proposals:

- Emissions targets are to be reached over a five-year budget period as proposed by the U.S., rather than by a single year. Allowing emissions to be averaged across a budget period increases flexibility by helping to smooth out short-term fluctuations in economic performance or weather, either of which could spike emissions in a particular year.

- The first budget period will be the U.S. proposal of 2008-2012. The Parties rejected proposals favored by others, including budget periods beginning as early as 2003, that were neither realistic nor achievable. Having a full decade before the start of the binding period will allow more time for U. S. companies to make the transition to greater energy efficiency and/or lower carbon technologies.

- The emissions targets include all six major greenhouse gases. The EU and Japan initially favored counting only three gases — carbon dioxide, methane, and nitrous oxide. Ensuring the inclusion of the additional gases (synthetic substitutes for ozone-depleting CFCs) that are highly potent and long-lasting in the atmosphere provides more comprehensive environmental protection and lends more certainty concerning the treatment of the additional gases.

- Activities that absorb carbon, such as planting trees, will be offset against emissions targets. The treatment of these so-called "sinks" was another controversial issue at Kyoto. Many countries wanted sinks to be excluded. The United States insisted that they be included in the interest of encouraging activities like afforestation and reforestation. Accounting for the role of forests is critical to a comprehensive and environmentally responsible approach to climate change. It also provides the private sector with low-cost opportunities to reduce emissions.

Is the target the United States agreed to actually 7% lower than what the President proposed in October?

No. The 7% target represents at most a 3% real reduction below the President's initial proposal of reducing greenhouse gases to 1990 levels by 2008-2012. The remaining 4 percentage points result from certain changes in the way gases and sinks are calculated and do not reflect any increase in effort as compared to the President's original proposal.

Changing the baseline for the three synthetic greenhouse gasses from 1990 to 1995 accounts for about 1% of the 7% reduction. Use of these three gases has grown since 1990, so that permitting a 1995 baseline allows for a higher overall baseline than the Administration assumed last October when the President announced his goal of reaching 1990 levels by 2008-2012. Making reductions to meet a higher baseline is of course easier than making reductions to meet a lower baseline. Had the United States maintained the same level of effort assumed by the President in October, and no other factors had changed, the shift to a 1995 baseline for the three synthetic gases would,
alone, have transformed the President's goal of 1990 levels into a goal equivalent to 1% below 1990 levels.

Altering the accounting method for carbon-absorbing activities, such as planting trees, accounts for about 3% of the 7% reduction. The President's original goal assumed that the 1990 baseline would be lowered by carbon-absorbing activities, but under the method agreed in Kyoto, such activities do not lower the 1990 baseline. Because the 1990 level baseline is thus higher under the Kyoto agreement, the U.S. target becomes somewhat less stringent. Specifically, had the U.S. maintained the same level of effort assumed by the President in October, and no other factors had changed, the shift in the accounting method for carbon-absorbing activities would, alone, have transformed the President's goal of 1990 levels into a goal equivalent to at least 3% below 1990 levels. (As noted above, certain carbon-absorbing activities will count against emission reduction commitments in the budget period.)

INTERNATIONAL EMISSIONS TRADING

The United States prevailed in securing acceptance of emissions trading among nations with emissions targets. This free market approach, pioneered in the U.S., will allow countries to seek out the cheapest emissions reductions, substantially lowering costs for the U.S. and others.

Under an emissions trading regime, countries or companies can purchase less expensive emissions permits from countries that have more permits than they need (because they have met their targets with room to spare). Structured effectively, emissions trading can provide a powerful economic incentive to cut emissions while also allowing important flexibility for taking cost-effective actions.

The Kyoto Protocol enshrines emissions trading. Rules and guidelines — in particular for verification, reporting, and accountability — are to be discussed at the next meeting of the Parties at Buenos Aires in November 1998.

The inclusion of emissions trading in the Kyoto Protocol reflects an important decision to address climate change through the flexibility of market mechanisms. Led by the United States, the Conference rejected proposals to require all Parties with targets to impose specific mandatory measures, such as energy taxes.

The United States also reached a conceptual agreement with a number of countries, including Australia, Canada, Japan, New Zealand, Russia and Ukraine, to pursue an umbrella group to trade emissions permits. Such a trading group could further contribute to cost-effective solutions to this problem.

JOINT IMPLEMENTATION AMONG DEVELOPED COUNTRIES

Countries with emissions targets may get credit towards their targets through project-based emission reductions in other such countries. The private sector may participate in these activities.

Additional details may be agreed upon by the Parties at future meetings.

CLEAN DEVELOPMENT MECHANISM

Another important free market component of the Kyoto Protocol is the so-called "Clean Development Mechanism" (CDM). The CDM embraces the U.S. proposal for "joint implementation for credit" in *developing* countries.

With the Clean Development Mechanism, developed countries will be able to use certified emissions reductions from project activities in developing countries to contribute to their compliance with greenhouse gas reduction targets.

This Clean Development Mechanism will allow companies in the developed world to enter into cooperative projects to reduce emissions in the developing world — such as the construction of high-tech, environmentally sound power plants — for the benefit of both parties. The companies will be able to reduce emissions at lower costs than they could at home, while developing countries will be able to receive the kind of technology that can allow them to grow more sustainably. The CDM will certify and score projects. The CDM can also allow developing countries to bring projects forward in circumstances where there is no immediate developed country partner.

Under the Clean Development Mechanism, companies can choose to make investments in projects or to buy emissions reductions. In addition, Parties will ensure that a small portion of proceeds be used to help particularly vulnerable developing countries, such as island states, adapt to the environmental consequences of climate change.

Importantly, certified emissions reductions achieved starting in the year 2000 can count toward compliance with the first budget period. This means that private companies in the developed world will be able to benefit from taking early action.

DEVELOPING COUNTRIES

Various Protocol provisions, taken together, represent a down payment on developing country participation in efforts to reduce greenhouse gas emissions:

- Developing countries will be engaged through the Clean Development Mechanism, noted above.

- The Protocol advances the implementation by all Parties of their commitments under the 1992 Framework Convention on Climate Change. For example, the Protocol identifies various sectors (including the energy, transport, and industry sectors as well as agriculture, forestry, and waste management) in which actions should be considered in developing national programs to combat climate change and provides for more specific reporting on actions taken.

Developing countries may, as a prerequisite for engaging in emissions trading, voluntarily assume binding emissions targets through amendment to the annex of the Protocol that lists countries with targets. The Kyoto Protocol does not include a separate article for nations to voluntarily assume binding emissions targets.

Securing meaningful participation from key developing countries remains a priority for the United States. The Administration has stated that without such participation, it will not submit the Kyoto Protocol to the Senate for advice and consent to ratification.

MILITARY EMISSIONS

The Kyoto Protocol achieves the objectives identified by the Department of Defense where international agreement was necessary to protect U.S. military operations.

- Emissions from "bunker" fuels (for international maritime or aviation use) are exempted from emissions limits.

- Emissions from multilateral operations pursuant to the United Nations Charter are exempted from emissions limits. This includes not only multilateral operations expressly authorized by the UN Security Council (such as Desert Storm, Bosnia, Somalia) but also multilateral operations not expressly authorized that are nonetheless pursuant to the UN Charter, such as Grenada.

- Countries may decide, among themselves, how to account for emissions relating to multilateral operations (for example, U.S. training in another NATO country). This provision avoids the need to use emissions trading to allocate such emissions.

COMPLIANCE AND ENFORCEMENT

The Protocol contains several provisions intended to promote compliance. These include requirements related to measurement of greenhouse gases, reporting, and review of implementation.

The Protocol also contains certain consequences for failure to meet obligations. For example, as a result of a U.S.-proposed provision, a Party not in compliance with its measurement and reporting requirements cannot receive credit for joint implementation projects.

Effective procedures and a mechanism to determine and address non-compliance are to be decided at a later meeting. For both environmental and competitiveness reasons, the United States will be working on proposals to strengthen the compliance and enforcement regime under the Protocol.

ENTRY INTO FORCE

The Kyoto Protocol will be open for signature in March 1998. To enter into force, it must be ratified by at least 55 countries, accounting for at least 55 percent of the total 1990 carbon dioxide emissions of developed countries. U.S. ratification will require the advice and consent of the Senate.

The Kyoto Protocol

Fact Sheet released by the Bureau of Oceans and International Environmental
and Scientific Affairs
U.S. Department of State, November 2, 1998

Background

At a conference held December 1-11, 1997, in Kyoto, Japan, the Parties to the UN Framework Convention on Climate Change agreed to an historic Protocol to reduce greenhouse gas emissions by harnessing the forces of the global marketplace to protect the environment.

Key aspects of the Kyoto Protocol include emissions targets, timetables for industrialized nations, and market-based measures for meeting those targets. The Protocol makes a down payment on the meaningful participation of developing countries, but more needs to be done in this area. Securing meaningful developing country participation remains a core U.S. goal.

Emissions Targets

A central feature of the Kyoto Protocol is a set of binding emissions targets for developed nations. The specific limits vary from country to country, though those for the key industrial powers of the European Union, Japan, and the United States are similar — 8 percent below 1990 emissions levels for the European Union, 7 percent for the United States, and 6 percent for Japan.

The framework for these emissions targets includes the following provisions:

— Emissions targets are to be reached over a five-year budget period rather than by a single year. Allowing emissions to be averaged across a budget period increases flexibility by helping to smooth out short-term fluctuations in economic performance or weather, either of which could spike emissions in a particular year.

— The first budget period will be 2008-2012. The parties rejected budget periods beginning as early as 2003, as neither realistic nor achievable. Having a full decade before the start of the binding period will allow more time for companies to make the transition to greater energy efficiency and/or lower carbon technologies.

The emissions targets include all six major greenhouse gases: carbon dioxide, methane, and nitrous oxide, as well as three synthetic substitutes for ozone-depleting CFCs that are highly potent and long-lasting in the atmosphere.

Activities that absorb carbon, such as planting trees, will be used as offsets against emissions targets. "Sinks" were also included in the interest of encouraging activities like afforestation and reforestation.

Accounting for the role of forests is critical to a comprehensive and environmentally responsible approach to climate change. It also provides the private sector with low-cost opportunities to reduce emissions.

International Emissions Trading

The Kyoto Protocol allows nations with emissions targets to trade greenhouse gas allowances. Using this mechanism, countries can achieve reductions at the lowest cost. Emissions trading was developed in the United States to reduce sulfur dioxide that causes acid rain and has been successful beyond expectations.

Under an emissions trading regime, countries or companies can purchase less expensive emissions permits from countries that have more permits than they need (because they have met their targets with room to spare). Structured effectively, emissions trading can provide a powerful economic incentive to cut emissions while also allowing important flexibility for taking cost-effective actions.

The Kyoto Protocol established emissions trading. Rules and guidelines — in particular for verification, reporting, and accountability — will be developed.

The inclusion of emissions trading in the Kyoto Protocol reflects an important decision to address climate change through the flexibility of market mechanisms. The Conference rejected proposals to require all Parties with targets to impose specific mandatory measures, such as energy taxes.

A number of countries, including Australia, Canada, Japan, New Zealand, Russia, Ukraine, and the United States, reached a conceptual agreement to pursue, through an umbrella group, the implementation of a trading regime. Such a group could further contribute to cost-effective solutions to this problem.

Joint Implementation Among Developed Countries

Countries with emissions targets may obtain credit toward their targets through project-based emission reductions in other such countries. The private sector may participate in these activities.

Additional details may be agreed upon by the Parties at future meetings.

Clean Development Mechanism

Another important market-based component of the Kyoto Protocol is the so-called Clean Development Mechanism (CDM). The CDM embraces the concept of joint implementation for credit in developing countries.

With the Clean Development Mechanism, developed countries will be able to use certified emissions reductions from project activities in developing countries to contribute to their compliance with greenhouse gas reduction targets.

This Clean Development Mechanism will allow companies in the developed world to enter into cooperative projects to reduce emissions in the developing world — such as the construction of high-tech, environmentally sound power plants — for the benefit of both parties. The companies will be able to reduce emissions at lower costs than they could at home, while developing countries will be able to receive the kind of technology that can allow them to grow more sustainably. The CDM will certify and score projects. The CDM can also allow developing countries to bring projects forward in circumstances where there is no immediate developed country partner.

Under the Clean Development Mechanism, companies can choose to make investments in projects or to buy emissions reductions. In addition, Parties will ensure that a small portion of proceeds are used to help particularly vulnerable developing countries, such as island states, adapt to the environmental consequences of climate change.

Importantly, certified emissions reductions achieved starting in the year 2000 can count toward compliance with the first budget period. This means that private companies in the developed world will be able to benefit from taking early action.

Developing Countries

Various Protocol provisions, taken together, represent a down payment on developing country participation in efforts to reduce greenhouse gas emissions.

Developing countries will be engaged through the Clean Development Mechanism, noted above.

The Protocol advances the implementation by all Parties of their commitments under the 1992 Framework Convention on Climate Change. For example, the Protocol identifies various sectors (including the energy, transport, and industry sectors as well as agriculture, forestry, and waste management) in which national programs should be developed to combat climate change. The Protocol also provides for more specific reporting on actions taken.

Securing meaningful participation from key developing countries remains a priority for the United States. The Administration has stated that without such participation, it will not submit the Kyoto Protocol to the Senate for advice and consent to ratification.

Compliance and Enforcement

The Protocol contains several provisions intended to promote compliance. These include requirements related to measurement of greenhouse gases, reporting, and review of implementation.

The Protocol also contains certain consequences for failure to meet obligations. For example, a Party not in compliance with its measurement and reporting requirements cannot receive credit for joint implementation projects.

Effective procedures and a mechanism to determine and address noncompliance are to be decided at a later meeting. For both environmental and competitiveness reasons, the United States will be working on proposals to strengthen the compliance and enforcement regime under the Protocol.

Entry Into Force

The Kyoto Protocol opened for signature in March 1998. To enter into force, it must be ratified by at least 55 countries, accounting for at least 55 percent of the total 1990 carbon dioxide emissions of developed countries. U.S. ratification will require the advice and consent of the Senate.

International Emissions Trading

Fact Sheet released by the Bureau of Oceans and International Environmental
and Scientific Affairs
U.S. Department of State, November 2, 1998

The Kyoto Protocol combines ambitious environmental targets with innovative market-based mechanisms to help Parties achieve those targets at the lowest possible cost. Recognizing that the cost of reducing greenhouse gas emissions is many times greater in some countries than in others, the Protocol allows each country with a binding target (an Annex B country) to use "emissions trading" and other flexibility mechanisms to meet their commitments.

How Emissions Trading Would Work

In an emissions trading system, Annex B countries and their authorized private entities will be able to purchase emissions allowances from each other. Each Annex B country's binding target determines how many allowances it has. Countries may buy or sell these emissions allowances at the government-to-government level. Countries may also authorize their legal entities (companies, individuals, NGOs, etc.) to buy and sell emissions allowances. If the cost of controlling emissions is different in two countries, both will benefit if the one facing lower costs sells some of its emissions allowances to the other. The environmental impact of reducing greenhouse gases will be the same no matter where the reductions take place. Thus, emissions trading will allow the overall reduction required by the Kyoto targets to be achieved at a lower total cost, with both buyers and sellers gaining from the savings allowed by trading.

U.S. Experience with Emissions Trading

U.S. experience with domestic emissions trading has been highly successful. The acid rain provisions of the federal Clean Air Act allow electric power plants to trade sulfur dioxide allowances, resulting in an active private market. Emissions are being cut significantly ahead of schedule--over the last three years, emissions have been reduced over 30% more than required—and the cost of emissions reductions has been less than 50% of what was expected.

Benefits of Trading

In order to provide real environmental benefits, a trading system must have mechanisms for verification, reporting, and accountability that meet high standards. At the same, the system must be designed to be as efficient as possible to result in cost-effective reductions. Greenhouse gas emissions trading will bring many benefits. It would:

— Promote ratification of and global compliance with the Protocol by making reductions less costly. Trading will also provide incentives to reduce emissions below target levels;

— Cut the cost of reducing greenhouse gases by allowing the marketplace to identify the most cost-effective reductions, thereby making efficient use of scarce global resources; and
— Quicken the pace at which countries address climate change by creating a market for innovative ways to reduce emissions cost-effectively and fostering the rapid development and diffusion of new technologies that reduce emissions.

Next Steps

The rules of an emissions trading system need to be clear and predictable—ensuring the integrity of the process while avoiding restrictions that would burden the market or reduce cost savings. To participate in trading, a country must take on a binding target under the Protocol and meet the high standards of the emissions trading system. The U.S. is working with a number of countries to help establish the necessary measurement and reporting capacity.

The Clean Development Mechanism

Fact Sheet released by the Bureau of Oceans and International Environmental
and Scientific Affairs
U.S. Department of State, November 2, 1998

At Kyoto, industrialized and developing nations came together to formulate an innovative, market-based approach to promoting sustainable development and providing cost-effective reductions of greenhouse gas emissions. The Clean Development Mechanism (CDM) is a win-win proposition in which industrialized countries or their companies could earn emissions credits while developing countries acquire technology and capital and earn emission credits that could be banked or sold.

How CDM Could Work

The CDM might work as follows: a company from an industrialized country could help build a highly efficient plant in a developing country rather than a less efficient plant previously planned. This would result in emissions reductions below what would have been the case without the project investment. Those reductions would be certified as credits, and the developing nation and investing company would then determine how to share the credits. The developing country could acquire technology and capital investment as well as a share of credits it could sell or bank. The company could acquire a share of credits it could use to meet its emissions reduction commitments at home.

Benefits of the CDM

— Promotes Sustainable Development. The CDM will assist in achieving sustainable development by providing an incentive for investments in developing countries, helping those countries get on a path toward cleaner energy and economic growth.
— Encourages Meeting Environmental Goals. The CDM, in combination with emissions trading and joint implementation, will allow developed countries to secure the most cost-effective emissions reductions wherever they may be found.
— Spurs Technology Investment. The CDM promotes the diffusion of climate-friendly technologies and creates a worldwide market for them.
— Helps Meet the Costs of Adaptation. Finally, the CDM will aid those countries that are most vulnerable to climate change since, under the Protocol, a "share of the proceeds" from qualifying projects is to be used to assist those countries in meeting the costs of adaptation.

Next Steps

The U.S. is committed to working with the international community to develop operational rules as quickly as possible, especially in view of the Protocol provisions allowing CDM activities to begin as early as 2000. The Parties need to work through a number of issues relating to how the CDM will function, including determining roles for baselines, verification, institutional structures, and allocation of project proceeds. Work on these issues will begin at Buenos Aires and should be guided by the following key principles:

— The CDM should assist developing countries in achieving sustainable development;
— The CDM should be a flexible, market-based mechanism that ensures cost-effective reductions through public and private sector investment in clean energy and carbon sequestration projects;
— The CDM should help ensure compliance with targets and be based on principles of efficiency, transparency, and accountability; and
— Wherever possible, the CDM should use existing institutions to streamline the process.

The U.S. Country Studies Program

Fact Sheet released by the White House, November 1998

The U.S. Country Studies Program (USCSP) was announced in 1992, at the "Earth Summit" in Rio de Janeiro, Brazil. The purpose of the program is to provide financial and technical assistance to developing countries and countries with economies in transition in addressing the problem of global climate change, particularly within the context of the UN Framework Convention on Climate Change (UNFCCC). Since 1993, funding for the Country Studies Program has totaled $40 million. The program assists countries to:

- Inventory their emissions of greenhouse gases;
- Assess their potential vulnerability to climate change and approaches for adapting to such change;
- Identify and evaluate options for controlling these gases or increasing sinks;
- Develop national plans for responding to climate change;
- Assess related technological needs; and
- Increase public understanding of climate change.

How It Works

To enhance the long-term capacity of developing and transition countries to address the problem of climate change and to participate fully in the international response to this problem, the U.S. Country Studies Program provides participants with financial support, training, technical assistance, computer equipment, data, analytical tools, and information services. Fifteen senior officials from the participating countries have helped shape the program by working for a number of months each with the Country Studies Management Team in Washington. Thus, handbooks to guide studies, state-of-the-art simulation models, and analytical methodologies and tools have been tailored to meet the needs of the countries. During the life of the program, training has been provided in 10 global training workshops and over 20 regional workshops. Building on the work of analysts from developing and transition countries, more than 350 publications and journal articles have been produced, including 10 guidance documents, 60 workshop and conference proceedings, more than 160 country reports, and 17 special journal editions.

Wide Participation

Fifty-five countries have been involved in the Country Studies Program since 1993. Forty-three countries have received support for the development of greenhouse gas emission inventories, and 26 have submitted final emission inventories. Forty-nine countries have received support for conducting vulnerability and adaptation assessments, and 34 have completed these assessments. Thirty-four countries have initiated studies of mitigation options, and 27 have completed these studies. Eighteen countries have initiated the development of national action plans, and 4 have completed these plans.

Achievements

- China: Since 1994, the People's Republic of China (P.R.C.) has been active in several areas of the U.S. Country Studies Program. China's completed country study includes a greenhouse gas emissions inventory, an assessment of the P.R.C.'s potential vulnerability to climate change in a number of sectors, and an evaluation of technologies and strategies for mitigating climate change. The Country Studies Program also has provided technical assistance for the development of a national climate change action plan, which will be completed in early 1999.

- **Mexico:** Since 1993, the U.S. Country Studies Program has worked with Mexico on the development of a greenhouse gas emissions inventory, an assessment of Mexico's potential vulnerability to climate change, the development of future emission scenarios, the identification and evaluation of measures for adapting to or mitigating climate change, and the development of a national action plan.

- **Egypt:** With the support of the U.S. Country Studies Program, the Egyptian Organization for Energy Conservation and Planning (OECP) coordinated a 2-day workshop in June 1997 on its "National Action Plan and National Communication." The workshop was organized to present the Framework of Egypt's National Action Plan (developed with USCSP support), Egypt's climate change program, and guidelines for the preparation of its first National Communication to the Framework Convention on Climate Change. The former governor of Alexandria, the head of the Egyptian Environmental Affairs Agency, and the chairman of OECP led the workshop, which was attended by high-level government officials, industrialists, non-government organizations, and representatives of the media.

U.S. Domestic Climate Change Program

Fact Sheet released by the Bureau of Oceans and International Environmental
and Scientific Affairs
U.S. Department of State, November 2, 1998

The U.S. is undertaking a vigorous plan for reducing domestic greenhouse gas emissions. This plan, outlined by President Clinton in October 1997, emphasizes win-win initiatives designed to cut emissions by increasing energy efficiency; developing new, cleaner energy technologies; working with industry and others to promote sensible solutions; and employing market-based mechanisms to ensure cost-effective reductions. Important elements of President Clinton's plan include:

Clean Energy Investments and Incentives. The Climate Change Technology Initiative — a vigorous program of tax cuts and research and development aimed at improving energy efficiency and spurring the use of renewable energy sources — represents an additional $6.3 billion over 5 years ($3.6 billion in tax cuts and $2.7 billion in new investment). In response to the President's climate change request, the Fiscal Year 1999 appropriations bills include over $1 billion for investments in U.S. energy efficiency and renewables — a 25% increase over last year. Included in this package are additional funds for:

— Partnership for a New Generation of Vehicles, a government-industry effort to develop safe, attractive, affordable cars that are three times as fuel efficient as today's autos. Similar efforts are underway to develop cleaner, more efficient diesel engines for both light and heavy trucks.

— Partnership for Advancing Technology in Housing, a partnership with the homebuilding sector to build new homes that are 50% more energy-efficient and retrofit at least 15 million existing homes to make them 30% more energy efficient within the next decade.

— Energy Star Buildings and Green Lights, voluntary programs that encourage individual building owners, developers, and managers to install energy efficient lighting and maximize energy savings. Buildings that are in the top 25% in energy efficiency qualify for an "Energy Star Buildings" label. Major buildings that have already signed up include: the Empire State Building, the World Trade Center, and Chicago's Sears Tower.

— Renewable Energy research partnerships to accelerate price reductions and improve performance in areas such as wind, photovoltaics, geothermal, biomass, and hydropower, and for the President's Million Solar Roofs initiative, which aims to install solar panels on one million U.S. roofs over the next 10 years.

Industry Consultations. Senior White House staff are meeting with top management from key industrial sectors, including, to date, aluminum, steel, forest products, utilities, cement, and natural gas pipelines to encourage voluntary efforts to cut emissions. These sector-by-sector consultations identify opportunities to remove barriers to the development and widespread use of energy efficient technologies and practices. The President has made clear his commitment to provide appropriate credit to firms that take action to reduce emissions before the Kyoto Protocol's first commitment period.

Electricity Restructuring. In March, the Administration introduced its electricity restructuring proposal that, by encouraging competition, will save consumers $20 billion a year on electricity bills and reduce greenhouse gas emissions by roughly 25 to 40 million metric tons per year.

Federal Energy Use and Procurement. The President's plan includes making substantial improvements in the Federal government's own use and procurement of energy. In July, the President announced the first four elements of his plan focusing on the building sector.

Climate Change Action Plan. In 1993, following the United States' ratification of the U.N. Framework Convention on Climate Change, President Clinton launched the Climate Change Action Plan (CCAP). The CCAP focused on promoting voluntary initiatives across a wide array of industries and sectors of the economy to reduce greenhouse gas emissions. Examples of the CCAP not discussed above include: Climate Challenge, Climate Wise, Industries of the Future, Motor Challenge, Voluntary Aluminum Industrial Partnership, Energy Star Products, Energy Efficiency Standards for Equipment and Appliances, WasteWise, Methane Reduction Programs, Energy Smart Schools, State and Local Climate Change Program, and U.S. Country Studies Program.

New Climate Science Findings

Fact Sheet released by the Bureau of Oceans and International Environmental
and Scientific Affairs
U.S. Department of State, November 2, 1998

Significant new findings over the past year reinforce the broad scientific consensus that human activities are disrupting the Earth's climate. New analyses of tree ring, ice melt, borehole, and satellite data provide further evidence that global temperatures are rising as a result of increasing atmospheric concentrations of greenhouse gases.

Temperatures Warmest in 600 Years
(Mann, et al., Nature 392:779-787; Pollack, et al., Science 282:279-280)

Two independent studies published this year have provided additional evidence of the unusual nature of 20th-century warming. In a study published in Nature, scientists used climate indicators, such as tree rings, corals and ice cores, to analyze surface temperatures for the Northern Hemisphere back to 1400. They found the 1990s to be the warmest decade in the last six centuries. Similarly, Science published results from scientists who measured temperatures in 358 boreholes (holes drilled deep in the Earth's surface) in North America, Europe, Africa, and Australia. They found that the average surface temperature has increased in the last five centuries (approximately 1.8 degrees F) and that half of this warming has occurred this century.

1997 Warmest Year on Record
(NOAA National Climatic Data Center)

In January, the U.S. National Oceanic and Atmospheric Administration (NOAA) announced that 1997 was the warmest year on record — agreeing with a November 1997 analysis by the UK Meteorological Office — and that 9 of the last 11 years have been the warmest this century.

Warming Found in Satellite Temperature Measurements
(Wentz, et al., Nature 394:661-664)

A new analysis of satellite temperature trends for the lower atmosphere (troposphere) bring them into closer agreement with ground-based temperature trends. The study re-analyzed data from Microwave Sounding Unit instruments aboard NOAA weather satellites and found that they show the troposphere is warming at a rate of 0.07 degrees C per decade. This work suggests that the cooling of 0.05 degrees C per decade reported in previous analyses was the result of a failure to account for the effect of decaying (or lowering) satellite orbits.

Stability of West Antarctic Ice Sheet Questioned
(Oppenheimer, Nature 393:325-332)

According to a study published in Nature, human-induced climate change over the next century could irreversibly affect the Western Antarctic Ice Sheet, leading to its inevitable collapse in the next 500-700 years and causing a rise in sea level of 4 to 6 meters. The study concludes that while uncertainties remain, recent trends indicate that collapse is the most likely scenario if human-induced climate change is not slowed.

Greenhouse Gas Increases May Delay Antarctic Ozone Hole Recovery
(WMO, 1998)

Greenhouse gases trap heat in the lower atmosphere, which contributes to a cooling of the upper atmosphere that leads to increased ozone destruction. With global adherence to the Montreal Protocol, the ozone layer should begin recovering early next century, but increasing greenhouse gases are expected to slow that recovery. On October 6, the U.S. National Aeronautics and Space Administration and NOAA announced that the Antarctic "ozone hole" has reached a record size in area, and a near-record size in depth.

Evidence for Large North America Carbon Sink
(Fan, et al., Science 282:442-446)

Researchers have found evidence that North American ecosystems may be absorbing significant amounts of carbon dioxide from the atmosphere — on the order of 1.7 Gt C per year from 1988 to 1992. These results suggest that most of the assumed missing terrestrial carbon sink is in North America. This new estimate is much larger than previous estimates of the North American sink.

Congressional Research Service Documents

97-1015 F
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CRS Report for Congress

Received through the CRS Web

Global Climate Change: The Role of U.S. Foreign Assistance

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Foreign Affairs and National Defense Division

Summary

With their expanding populations and growing economies, developing countries are expected by the year 2010 to account for roughly half of emissions of the greenhouse gases that most experts believe cause global warming. The Clinton Administration has announced a $1 billion five year effort to help developing countries cut emissions and meet the goals of the climate change treaty. The initiative follows on years of funding by the U.S. Agency for International Development of projects to promote efficient energy use, combat deforestation, and encourage adoption of appropriate environmental policies in developing countries.

Developing Countries and Global Warming

The part played by developing countries in the global warming phenomenon that many believe may eventually threaten climatic stability, world food supplies, and even the existence of some island nations is the subject of some controversy. The current Framework Convention on Climate Change embraces the principle that developed and developing countries bear different responsibilities and possess different capabilities to deal with the problem. Developed nations are expected to assist developing nations to meet convention objectives with financial and technical aid.

An amendment to the convention to reduce emissions of "greenhouse gases" aimed at establishing legally binding commitments for developed countries is currently under negotiation and is expected to be concluded in Kyoto, Japan in December 1997. Under the Byrd resolution (S.Res. 98), approved in a 95-0 vote, the Senate has gone on record to say that it would not support a treaty that excludes the developing nations from binding commitments and emission reduction targets. Developing countries say they will not make commitments until the developed countries do so first. (See CRS Issue Brief 89005, *Global Climate Change*, for discussion of related issues).

Although the 36 industrialized developed and "transition" countries are historically responsible for the majority of greenhouse gases that may cause global warming, the roughly 130 developing countries, by virtue of their growing populations and nascent, but rapidly expanding, economies, are expected to contribute half of all such emissions by the year 2010. Exacerbating the role of developing countries in climate change are their less advanced methods of pollution control. They currently require 40% more energy than developed nations to produce the same value of goods and services. State-owned utilities, using poor equipment, and subsidized energy prices have led to inefficient energy uses. Further, widespread deforestation — primarily caused by forest burning and a product of population pressures and poverty in developing countries — is estimated to be responsible for up to 20% of net annual increases in carbon emissions.

The President's $1 Billion Initiative

In June 1997, the Administration announced a $1 billion 5-year Developing Country Climate Change Initiative that would seek to reduce greenhouse gas emissions and help countries meet the goals of the climate change treaty. It consists of three elements. First, it would provide a minimum of $750 million — $150 million per year — in bilateral grant assistance for climate change related programs. Second, it would support up to $250 million in "climate-friendly" investment through the use of credits, subsidized by the U.S. government. The credit program would require congressional authorization.

The third component of the Initiative is a $25 million Inter-Agency Climate Change Program. The latter consists largely of two existing programs — a U.S. Initiative on Joint Implementation (begun in October 1993) that encourages U.S. and other-country partners to work on joint projects to reduce greenhouse gases, and a Country Studies Program that provides support to more than fifty countries to assess their greenhouse gas emissions and ways of mitigating climate change.

Much of the proposed spending consists of repackaged or redirected funding already built in to USAID's budget projections, but, in all, the Administration proposes that, over the next five years, as much as $250 million of the funds targeted on global warming will be new funds — additional to current program expenditure levels. Besides the $1 billion for the initiative, other funds would go toward helping a number of vulnerable countries adapt to the effects of climate change – increasing disaster preparedness, developing more adaptive crops, introducing flood control technologies, etc. Funding for the Initiative is expected to come out of amounts normally provided for environmental activities under the annual foreign operations appropriations bill.

The Initiative is primarily aimed at nine countries and three regions thought to be or expected to become key contributors to total global greenhouse gas emissions: Brazil, Central Africa, Central America, Central Asia, India, Indonesia, Mexico, Philippines, Poland, Russia, South Africa, and Ukraine. At least 40% of the grant funds are expected to go to these target countries/regions. In addition, a significant percentage of funds under the Initiative will go to Egypt — a major recipient of U.S. foreign assistance — and the rest elsewhere. Two thirds of the credit program would be targeted on focus countries/regions. China, the most significant developing country contributor of greenhouse gases, is not a recipient of U.S. foreign aid.

Background: USAID and Global Climate Change

Under the auspices of the Agency for International Development (USAID), the U.S. foreign assistance program has attempted to affect the environmental policies and practices of developing countries since the 1970s. In response to a 1990 congressional mandate (P.L. 101-167, sec. 534), USAID established a Global Warming Initiative (GWI). This initiative supported projects totaling $191.6 million in FY1995, $174.2 million in FY1996, and an estimated $149.5 million in FY1997. To a large extent, the President's Global Climate Change Initiative is an extension and strengthening of these earlier and on-going efforts.

Although USAID has climate-related projects in 44 countries, the GWI has been targeted at the same countries now expected to be the focus of the President's Initiative. In terms of overall funding, most assistance has gone to Asia and the Near East — 49% in FY1996. In these regions, Egypt is the leading recipient. This is followed by Europe and the former Soviet Union (21%), Latin America (10%), and Africa (9%), with Armenia, Brazil, and Malawi among the chief recipients in their respective regions.

Most of the hundreds of USAID GWI activities seek to reduce sources or increase sinks of greenhouse gases and focus mainly on two sectors — energy and forestry. The **energy sector** accounts for one half of the potential global warming problem. The chief objectives of USAID within that sector are to promote developing country use of energy efficient technologies, renewable energy facilities, and low carbon-emitting energy systems through encouragement of private sector and public/private partnerships, policy and regulatory reform, and development of improved environmental standards and government institutional capacities.

An Energy Efficiency Project begun in 1992, for example, has helped set up a special $20-30 million fund for Brazilian medium sized commercial and industrial users to help finance their energy efficiency programs, and conducted workshops in India and elsewhere to introduce bankers and businessmen to energy efficiency financing mechanisms. The Project's Sustainable Cities Initiative hopes to stimulate private investment in energy efficient urban infrastructure with a series of pilot demonstration projects. In Ahmedabad, India, for instance, the Project has helped the municipal government, local utilities, and major resident textile companies to identify problems and solutions and locate financing for energy efficiency projects. Working with Mexico's National Energy Conservation Commission, the Project has supported the development of energy efficiency standards for that country.

Another project, the Clean Energy Production and Use Program, has sought to introduce new technologies to developing countries for cleaner use of fossil fuel-based energy production. For example, it helped retrofit the Manzanillo Power Station in Mexico with advanced combustion hardware that increased burner efficiency, reduced fuel requirements, and reduced plant emissions. In demonstration projects in Bangkok, Thailand, and in India, the Program sought to introduce electric vehicles, through emissions testing and conversion of fossil-fuel transport to electric. In Brazil, the Program is examining the potential recovery and commercial use of methane gas from solid waste landfills, a project with both health and, through associated reduction of carbon dioxide levels, environmental benefits.

USAID also supports projects fostering use of renewable energy. These include an Environmental Enterprises Assistance Fund that provides loans, equity capital, training, and technical assistance to renewable energy businesses in developing countries. The Biomass Energy Systems and Technology project funds demonstration projects using biomass wastes, such as sugar cane residue, for power and liquid fuel production.

Roughly one quarter of all carbon released from combustion comes from tropical forests cleared for agriculture. USAID therefore seeks to foster sound **forestry and natural resource** management practices, with the hope that this will lead to reducing deforestation and other carbon-emitting land-use changes and increasing carbon sinks by establishing new forests. Between 1991 and 1995, USAID spent more than $425 million in the forestry sector. In Brazil, for instance, USAID supports the development of a model for reduced impact logging with eight demonstration plots in the Amazon, is monitoring forest burning using satellite imagery, and has facilitated a partnership between Brazilian NGOs and the Brazilian government's EPA to manage a national park.

In the Philippines, USAID established a Community-Based Forest Management Program which seeks to give local communities the ability to make decisions regarding land use, by making legal agreements between the government and local groups. In Haiti, USAID funds reforestation efforts, including the planting of 85 million trees. In Guatemala, USAID supports the development of the Maya Biosphere Reserve which is protecting a forest area of 1.9 million hectares. And USAID is assisting the Central African Regional Program for the Environment (CARPE) to reduce deforestation in the Congo basin, by funding research to identify strategies for reducing the negative environmental consequences of logging and to promote better agricultural practices.

Issues for Congress

Despite the Administration's characterization of its Developing Country Climate Change Initiative as something new, it appears to add little substance to what USAID is already doing as a result of the Global Warming Initiative begun at congressional impetus in 1990. Moreover, the funding level proposed — at least $150 million in grant assistance per year — is less than pre-FY1997 levels for this activity. In the past few years, foreign aid environmental programs, traditionally strongly supported in Congress, have been squeezed by other developmental priorities — child survival and basic education, among them — and a decline in overall aid levels. Efforts to bring the developing countries to accept binding commitments in an amended Climate Change Convention are likely to be met by demands for developed country assistance to help them meet those commitments. While the FY1998 foreign operations appropriations levels suggest that proposed U.S. funding of climate change activities can be implemented in FY1998, future efforts to increase such funding might be problematic.

The effectiveness of these programs is also problematic. Although USAID is hoping to develop a methodology to measure impact, it funds hundreds of projects, where thousands may be needed to significantly affect country emission levels. Many of these are pilot demonstration projects that would have to be reproduced on a larger scale by the tens of thousands of businesses and millions of agriculturalists directly responsible for producing greenhouse emissions. To have a measurable impact on global warming, USAID programs also require the commitment of developing country governments to regulatory reform, strict enforcement, and other programs that might divert precious financial resources away from their economic growth and development priorities.

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Global Climate Change: Reducing Greenhouse Gases — How Much from What Baseline?

March 11, 1998

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Global Climate Change: Reducing Greenhouse Gases — How Much from What Baseline?

Summary

At the Kyoto meeting on Global Climate Change, the United States agreed to reduce emissions of six greenhouses gases. Specifically, under the terms of the Kyoto Protocol, from a baseline of 1990 for Carbon dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O), and of 1995 for Hydrofluorocarbons (HFCs), Perfluoro-carbons (PFCs), and Sulfur Hexafluoride (SF_6), the U.S. committed to reduce by 7% the average annual tons of carbon equivalent released during the 5-year period 2008-2012.

Projecting the reductions that would be required *if* the U.S. were to ratify the treaty is difficult. While emissions of CO_2 are fairly well established and account for about 85% of total carbon equivalent emissions, emissions of the other gases, especially N_2O, are more uncertain. Once the baselines are set, uncertainties in factors affecting sources of emissions—e.g., the rate of economic growth, changes in energy prices, the rate at which nuclear facilities are retired, and the rate of adoption of energy-efficient technologies — will have to be overcome in determining the actual magnitude of the reductions required. And uncertainties in how some reductions might be accomplished under the Agreement — e.g., the extent of emissions trading among different countries and whether and how to account for "sinks" that sequester carbon — affects assumptions about how (and at what cost) reductions will actually be achieved.

Given these uncertainties, it is not surprising that a range of estimates emerges from various studies making different assumptions on these variables. The U.S. has prepared a *Climate Action Report* specifically to address these issues. Based on its baseline of 1,596 million metric tons of carbon equivalent (MMTCE), this report estimates that to meet its Kyoto commitment the U.S. will have to reduce emissions in 2010 by 462 MMTCE, or 23.7% from "business as usual" emissions that would occur then. Projections of CO_2 emissions by other studies suggest reductions necessary to meet the Kyoto Agreement vary from 21% to over 30% from "business as usual" 2010 emission levels. These high and low projections differ only in assumptions about CO_2 emissions. None of the estimates quantitatively integrates the full range of potential variables that could affect CO_2 and other greenhouse gas emissions in the future, which include economic growth, electricity restructuring, electricity demand, and technological change and penetration, among others.

The reviewed estimates of the reduction necessary to meet the commitment — i.e., the reduction below "business as usual" emissions projected for 2008-2010 — range from approximately 390 to 660 MMTCE. Even ignoring numerous uncertainties, then, there remains a ~70% difference from the lower to higher reduction projected necessary to achieve the target. To comply with the higher compared to the lower estimate would represent a substantial escalation of effort and makes estimating potential costs difficult. In short, projecting future greenhouse gas emissions, the amount that they might have to be reduced if the U.S. ratifies the Kyoto agreement, and potential costs, are all fraught with considerable uncertainty.

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Global Climate Change: Reducing Greenhouse Gases — How Much from What Baseline?

At the Kyoto meeting on Global Climate Change, the United States agreed to reduce emissions of greenhouses gases.[1] Specifically, under the terms of the Kyoto Protocol, the United States committed that over the 5-year period 2008-2012, it would reduce its average annual net carbon-equivalent emissions of 6 gases by 7% below specified baseline years.[2] The gases and the baseline years are as follows:

Greenhouse Gas	Baseline Year
Carbon dioxide (CO_2)	1990
Methane (CH_4)	1990
Nitrous Oxide (N_2O)	1990
Hydrofluorocarbons (HFCs)	1995
Perfluorocarbons (PFCs)	1995
Sulfur Hexafluoride (SF_6)	1995

If the U.S. were to ratify the Kyoto Agreement, what would this commitment mean for the U.S.? What reductions would be required? Ascertaining the reductions necessary is a prerequisite to determining how the reductions might be achieved and what the impacts of those efforts might be.

Projecting the required reductions is a two-step process. First, emissions of the six greenhouse gases in their specified baseyear must be calculated in order to determine the targeted emission levels — i.e., 7% below baseyear level. This calculation is complicated because the existing 1990/1995 data for the six greenhouse gases are of uneven quality. While data for energy-related emissions of CO_2 are fairly robust, emissions data for the remaining five gases are less certain. Uncertainties also arise in comparing the relative global warming effects of the several gases, which involves converting them to metric tons of "carbon equivalents."

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[1] On the Agreement, see Susan R. Fletcher, *Global Climate Change Treaty: Summary of the Kyoto Protocol*, CRS Report 98-2, December 22, 1997; on the science and policy of global climate change, see Wayne A. Morrissey and John R. Justus, *Global Climate Change*, CRS Issue Brief 89005. For the Protocol, see http://www.UNFCCC.DE/

[2] Technically, the net carbon-equivalent emissions of the 6 greenhouse gases for the 5-year period 2008-2012 are not to exceed 5 times 93% of the baseline emissions. Kyoto Protocol, Article 3(1). This is equivalent to the *average annual emission load* during the 5 year period being 7% below the baseline.

Second, because the Kyoto Agreement caps greenhouse gas emissions below current levels, emissions growth that would have normally occurred up through the 2008-2012 time period must be offset in order to maintain the reduction. This requirement introduces numerous uncertainties into the calculations, including:

- Growth rates for the six greenhouse gases will be influenced by economic factors that are difficult to project into the future;
- Fossil fuel consumption (the major source of CO_2 emissions) will be influenced by energy policy considerations, including development of non-carbon based substitutes, deployment of energy efficient technologies, and other factors such as the future of the nuclear industry. Like economic factors, these factors are difficult to predict in lieu of a discrete climate change policy;
- Net effects of post-1990 human-induced activities that influence carbon sinks, such as forestry practices, will affect necessary reduction requirements in the 2008-2012 period;
- The Kvoto Agreement establishes mechanisms for achieving reductions jointly among nations. In effect, the inventory of emissions from which any one nation can achieve reductions is international. This does not influence the amount of reductions the U.S. would be required to accomplish; however, it offers the opportunity for the U.S. to achieve some portion of its reductions in other countries. Thus the actual amount by which greenhouse gases would be reduced within the U.S. will be influenced by any bilateral agreements through which U.S. interests sponsor emission reductions in other countries (and how much other countries seek reductions in the U.S.).

The Kyoto Baseline

The first step in calculating the reductions required to meet the Kyoto Agreement begins with estimating baseline year emissions. From this baseline, the mandated emissions limit can be calculated. This is no easy task.

The 1997 Submission of the United States of America Under the United National Framework Convention on Climate Change, the *Climate Action Report* (*CAR*),[3] contains U.S. emissions data relied upon during the Kyoto negotiations. **Table 1** depicts the baseline emissions as reported by the *CAR*. Carbon dioxide accounts for about 85% of the greenhouse effect of the 6 greenhouse gases; about 98% of this CO_2 comes from fossil fuel combustion. Fuel use data, which are relatively robust, provide the primary source for estimating historical CO_2 emissions. Emissions estimates for the other gases, especially N_2O, are considerably less certain.[4]

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[3] Office of Global Climate Change, *Climate Action Report*, 1997 Submission of the United States of America Under the United Nations Framework Convention on Climate Change (Department of State Publication 10496, July 1997).

Table 1. U.S. Baseline Year Greenhouse Gas Emissions

Greenhouse Gas	Baseline Year	Emissions (MMTCE)
Carbon dioxide (CO_2)	1990	1,353
Methane (CH_4)	1990	170
Nitrous Oxide (N_2O)	1990	36
Hydrofluorocarbons (HFCs)	1995	21
Perfluorocarbons (PFCs)	1995	8
Sulfur Hexafluoride (SF_6)	1995	8
Total		1,596

Source: *Climate Action Report*, p. 56. (Note: Emissions from burning international bunker fuel are excluded; for the U.S., this was about 22 MMTCE for 1995 [p. 60].)

These may not be the final figures. Before the next Conference of the Parties, scheduled for Buenos Aires in November, 1998, the Kyoto Protocol requires each Party to the Agreement "to provide ... data to establish its level of carbon stocks in1990 and to enable an estimate to be made of its changes in carbon stocks in subsequent years" (Article 3(4)). Methodologies for emissions estimates are to be those accepted by the Intergovernmental Panel on Climate Change and approved by the Conference of the Parties (Article 5 of the Protocol); guidelines for preparing information necessary to demonstrate compliance with the Protocol are to be adopted by the first session of the Conference of Parties to the Protocol (Article 7). To assure that all countries are using credible and comparable means of estimating emissions, the baseline estimates will be subject to review by "expert review teams" created under the Protocol (Article 8(2)).

For the U.S., some adjustments to the **Table 1** figures are likely. For CO_2 the changes are likely to be small; for example, Department of Energy data result in a slightly higher figure for U.S. CO_2 emissions. However, for the other gases, the revisions could be more substantial. The Protocol also requires that further studies of greenhouse gas emissions and removals be undertaken and incorporated in any future commitments for reducing greenhouse gases beyond the 2008-2012 target.

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[4] For example, it is possible that the nitrous oxide data contained in the *CAR* could be off by as much as a factor of three.

Based on the figures in **Table 1**, under the Kyoto agreement, the U.S. would be committed to emitting no more than 1,484 MMTCE annually on average during 2008-2012. This represents a reduction of 112 MMTCE annually below 1990 levels.

Projecting Emissions in 2008-2012

While the 1990/1995 baseline for the greenhouse gases contains uncertainties, those figures will be effectively frozen once the U.S. submits for review its compliance information as required by Articles 7 and 8. The reductions that will be required of the U.S. to meet its commitment under the Protocol will be the difference between 5 times 93% of the 1,596 MMTCE baseline (based on the emissions estimates from the 1997 *U.S. Climate Action Report*) and what would be "business as usual emissions" for the period 2008-2012. Estimating those "business as usual emissions" for 2008-2012 introduces the most uncertainty into the calculation of the reductions necessary to meet the terms of the Kyoto Protocol.

If emissions increase, the reductions required will be more than the 7% that would be required if average annual emissions during 2008-2010 were the same as for the base-years. But already, by 1995, emissions of the three 1990 baseyear greenhouse gases — CO_2, CH_4, and N_2O — had increased 9.5%. If the U.S. had reduced its 1995 emissions of these three gases to the level required by the Kyoto Protocol (7% below the baseline), the U.S. would have had to reduce its actual 1995 emissions of greenhouse gases by 155 MMTCE, or 9.4%.

But this 1995 calculation is based on historical data: the comparable calculation for 2008-2012 involves projections of substantial uncertainty. Such projections depend on a number of crucial assumptions involving economic activity and growth, interest rates, energy consumption, consumer behavior, technological change, policy interventions and their effectiveness, and others.

The *CAR* Projections

The 1997 *Climate Action Report* projects greenhouse gas emissions for the years 2000, 2005, 2010, and 2020. For evaluating the impact of the Kyoto Protocol, the 2010 projection falls in the middle of the target period. The projections presume continued funding support for the Administration's Climate Change Action Programs comparable to the 1997 levels approved by Congress.[5] The projected 2010 greenhouse emissions are shown in **Table 2** (the report discusses uncertainties,[6] but does not indicate potential error bars for these point estimates).

Based on the projection that net emissions will be 1,946 MMTCE in 2010, the average reduction necessary for the U.S. to meet its Kyoto commitment would be 462 MMTCE per year, or 23.7% below the "business as usual" emissions projected. This calculation does not include any net, human-induced change in U.S. carbon sinks from afforestation, reforestation, and deforestation that could affect the 2010 reduction estimate.

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[5] The *Climate Action Report* discusses this and other variables affecting projections, pp. 117-124.

[6] The *Climate Action Report* discusses uncertainties, pp. 127-130.

Sensitivity Analysis

Inevitably, such projections depend on assumptions. Other analyses result in different projections. At the current time, virtually all alternative analyses focus on CO_2 emissions, the largest component of greenhouse gases.

Economic Variables. The Energy Information Administration (EIA) publishes a projection of U.S. energy production and consumption annually, including projected CO_2 emissions from energy-related activities. The *Annual Energy Outlook 1998* projects carbon emissions for energy use under three economic growth scenarios. **Table 3** substitutes the EIA CO_2 projections (with its 1990 baseline adjusted to *CAR* estimate) for the *CAR* projection, while retaining the *CAR* projections for the other 5 greenhouse gases.

Table 2. Projected 2010 U.S. Greenhouse Gas Emissions — *CAR* Data

Greenhouse Gas	Baseline Year Emissions (MMTCE)	2010 Emissions (MMTCE)
Carbon dioxide (CO_2)	1,353	1,669
Methane (CH_4)	170	152
Nitrous Oxide (N_2O)	36	34
Hydrofluorocarbons (HFCs)	21	91
Perfluorocarbons (PFCs)	8	
Sulfur Hexafluoride (SF_6)	8	
Total	1,596	1,946

Source: *Climate Action Report,* p. 111

Using EIA's low economic growth scenario, projected total greenhouse gas emissions are about the same as *CAR's* point estimate (just 1% higher), while the reference case and high growth projections are considerably higher, implying greater reductions to meet the Kyoto commitment. For its reference case, EIA's projections would result in an average annual reduction of 577 MMTCE, or 28% below the 1990/1995 baseline, to meet the target in 2010. Under the high economic growth case, the U.S. emission reduction from the 1990/1995 baseline necessary to meet the target would be 657 MMTCE, or 30.7%, while under the low growth case it would be 487 MMTCE, or 24.7%.

Energy Policy Variables. EIA also conducts sensitivity analysis on several energy policy variables that could affect future energy production, consumption, and emissions. Three of these variables include: (1) the rate of development and penetration of energy efficient technologies, (2) trends in electricity demand, and (3) retirement of nuclear capacity. Using the reference case to freeze the economic variables, EIA varies these energy policy factors to determine how they would affect energy consumption, production, and emissions. With respect to CO_2 emissions, EPA projects:

- If energy efficient technologies are developed faster and penetrate markets more quickly than the reference case, 79 additional MMTCE would be saved in 2010. Conversely, if technological development and use stalls at 1998 levels, EIA estimates that 2010 emissions would be 31 MMTCE higher than the reference case[7];
- If electricity demand rises faster than anticipated, as might happen if electricity restructuring reduces prices, EIA estimates that 2010 emissions would be 29 MMTCE higher than for the reference case[8];
- If nuclear facilities (which displace carbon-emitting fossil fuel facilities) are held in service longer than assumed in the reference case, EIA estimates that 42 additional MMTCE would be saved in 2010; conversely, if nuclear facilities are retired faster than anticipated (as might happen if electricity restructuring reduces electricity prices) EIA estimates that 2010 emissions would be 15 MMTCE higher than assumed in the reference case.[9]

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[7] *EIA*, p. 193.

[8] *EIA*, p. 195.

[9] Interpolated from *EIA*, p. 55.

Table 3. Projected 2010 U.S. Greenhouse Gas Emissions — EIA CO_2 Data for Three Economic Growth Scenarios

Greenhouse Gas	Baseline Year Emissions (MMTCE)	2010 Emissions (MMTCE)
Carbon dioxide (CO_2)	1,353	High growth: 1,864 Reference: 1,784 Low growth: 1,694
Methane (CH_4)	170	152
Nitrous Oxide (N_2O)	36	34
Hydrofluorocarbons (HFCs)	21	91
Perfluorocarbons (PFCs)	8	
Sulfur Hexafluoride (SF_6)	8	
Total	1,596	High growth: 2,141 Reference: 2,061 Low growth: 1,971

Source: Energy Information Administration, *Annual Energy Outlook 1998*, with projections through 2020, DOE/EIA-0383(98) (December 1997), p. 152 [adjusted to equate to *CAR* baseline].

Thus EIA finds that the uncertainties injected by energy policy variables are comparable to the uncertainties resulting from economic variables.

Another analysis, prepared by the Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies (IWG) focuses on technology development and penetration and its potential impact on projected 2010 CO_2 emissions (see **Table 4**). To examine the potential for technology development to reduce CO_2 emissions, the analysis compares a "business as usual" case (based on EIA's 1997 reference case assumptions) with an efficiency case that assumes that 35% of cost-effective efficiency is captured. As stated by the report: "The general philosophy of the efficiency case is that it reduces, but does not eliminate, various market barriers and lags to the adoption of cost-effective energy efficient technology."[10]

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[10] Interlaboratory Working Group on Energy Efficient and Low-Carbon Technologies [Oak Ridge National Laboratory, Lawrence Berkeley National Laboratory, Argonne National Laboratory, National Renewable Energy Laboratory, Pacific Northwest National Laboratory, *Scenarios of U.S. Carbon Reductions*, p. 1.2
http://www.ornl.gov/ORNL/Energy_Eff/CON444/labweb.htm

Table 4. Projected 2010 U.S. Greenhouse Gas Emissions — Interlaboratory Working Group CO_2 Data for Energy Efficient Scenario

Greenhouse Gas	Baseline Year Emissions (MMTCE)	2010 Emissions (MMTCE)
Carbon dioxide (CO_2)	1,353	Business as Usual: 1,717 High Efficiency: 1,597
Methane (CH_4)	170	152
Nitrous Oxide (N_2O)	36	34
Hydrofluorocarbons (HFCs)	21	91
Perfluorocarbons (PFCs)	8	
Sulfur Hexafluoride (SF_6)	8	
Total	1,596	Business as Usual: 1,994 High Efficiency: 1,874

Source: Interlaboratory Working Group on Energy Efficient and Low-Carbon Technologies, *Scenarios of U.S. Carbon Reductions*, p. 1.6. [Adjusted to equate to *CAR* baseline.]

This group's "business as usual" baseline is somewhat lower than the EIA's 1998 "reference case," and a bit higher (plus 2.5%) than the *CAR* point estimate for 2010. The "business as usual" reduction estimate for 2010 resulting from this scenario would be 510 MMTCE per year, or 25.6% below the baseline to achieve the Kyoto target. However, under the group's "efficiency case," emissions drop substantially and are less than the *CAR's* point projection; in this case, the reductions necessary for the U.S. to meet its Kyoto commitment in 2010 would be 390 MMTCE, or 21% below the 1990/1995 baseline.

Carbon Sequestration Variables. A country's contribution to greenhouse gases not only consists of direct emissions but also is influenced by activities that affect carbon sinks — processes that remove and sequester carbon from the atmosphere. Activities that affect sinks include farming and forestry practices. A positive net growth of trees removes carbon from the atmosphere; clearing forests typically releases carbon. A nation's emission reduction commitment can be affected by net changes in sinks. According to the Protocol, "The net changes in greenhouse gas emissions from sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation, and deforestation since 1990, measured as verifiable changes in stocks ... shall be used to meet" the 2008-2012 commitments (Article 3(3)). Also, revised methods of accounting for "removals in the agricultural soil and land-use change and forestry categories" may be approved by the November 1998 Conference of Parties and be applied in meeting the 2008-2012 commitment, if the activities took place after 1990 (Article 3(4)).

The 1997 *U.S. Climate Action Report* estimates that in 1990 carbon sequestration represented a sink of 125 MMTCE and projects a slight decline in the future. However, the estimates are uncertain and may not reflect the way the Protocol ultimately assesses sinks. In estimating reductions necessary to meet the Kyoto commitment, a net increase in human-induced carbon sequestration from forestry practices between 1990 and 2008-2012 would be subtracted from emissions during the period, thereby reducing the amount of actual emissions that will have to be curtailed. Conversely, net negative sequestration from forestry practices would be added to the emissions that will have to be reduced.

Scope of Reductions: Other Considerations

In discussing the emission reductions required under the Kyoto agreement, there is a tendency to focus on domestic emissions of $CO_{2,}$, which account for 85% of U.S. greenhouse gas emissions and for which the data are the best. However, it is important to remember that the Kyoto Agreement involves 6 gases, not 1. Also, as the Agreement is international in terms of the emissions inventory available, the U.S. can seek reduction opportunities through bilateral trading and joint implementation. These considerations do not affect the amount of carbon-equivalent emissions that U.S. would be obligated to reduce; however, they can influence where some of those reductions may occur, and how much they would cost.

Reducing Emissions from Six Gases, Not One

While the 5 non-CO_2 gases account for only about 15% of U.S. greenhouse gas emissions, their impact on required reductions cannot be ignored. The *Climate Action Report* indicates that emissions of all 5 increased from 1990 to 1995. Any increase means that even greater reductions will probably come from CO_2 — with most of the impact of achieving those reductions falling on those burning fossil fuels. Of particular concern are HFCs and PFCs; while their present contribution to greenhouse gas emissions is small, their use has been growing rapidly, especially HFCs, which are replacing chlorofluorocarbons (CFCs) that are being phased out under the Montreal Protocol because they deplete stratospheric ozone. Unless effective means are developed to contain or eliminate these emissions, CO_2 emitting sources may bear an even greater share of the committed reductions than would otherwise be the case.

As suggested earlier, data on the five non-CO_2 gases are of considerably less quality than for energy-related CO_2 emissions, and their conversion to carbon equivalents entails some uncertainty. With the U.S. required to provide final estimates this year for its 1990/1995 baseline, this situation could lead to some significant problems. If the U.S. underestimates 1990/1995 emissions of these gases, the growth trend to 2008-2012 could be artificially increased because of the depressed baseline. This would result in additional reductions being required. In contrast, if the U.S. overestimates 1990/1995 emissions of these gases, the growth trend to 2008-2012 could be artificially reduced because of the inflated baseline. This would result in less required reductions (though failing to meet the spirit of the commitment). As previously noted, these baseline estimates will be subject to review by "expert review teams" created under the Protocol.

Emissions Trading Mechanisms

Any consideration of the domestic impacts of reducing greenhouse gas emissions under the Kyoto Agreement has to take into account the potential under the Agreement for some of those reductions to be accomplished elsewhere.[11] The Kyoto agreement does not require the U.S. to reduce its domestic emissions by a specific amount; rather, it requires the U.S. to reduce emissions from any certified source in a manner that results in the reduction requirement being met.

The Protocol establishes three mechanisms that expand the inventory of reduction opportunities.

Under article 4, the Protocol authorizes Annex I Parties[12] "to fulfill their commitments under Article 3 jointly" — in effect, this allows one country to emit greenhouse gases in excess of its commitment to the degree another country's emissions are lower than its commitment. Parties proposing joint fulfillment of commitments must formally notify the secretariat of their intent when they ratify or otherwise approve the Protocol.

Under article 6 of the Protocol, any Annex I Party "may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy...." The protocol spells out conditions for such emissions trading, including a requirement that it only "be supplemental to domestic actions for the purposes of meeting commitments...." The November 1998 Conference of Parties in Buenos Aires is to elaborate on guidelines for implementing this article with respect to verification and reporting. Parties can authorize private entities, such as corporations, to engage in emissions trades under this article.

Under article 12, the Protocol defines a "clean development mechanism" by which Annex I countries can gain credit for post-2000 emissions reductions achieved by assisting nonAnnex I countries in sustainable development activities that reduce emissions or enhance carbon sinks. Such "joint implementation" emissions reductions must be real and measurable; the November 1998 Conference of the Parties is to "elaborate modalities and procedures with the objective of ensuring transparency, efficiency and accountability through independent auditing and verification of project activities."

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[11] *Global Climate Change: Market-Based Strategies to Reduce Greenhouse Gases,* CRS Issue Brief 97057.

[12] Annex I Parties — listed in an Annex to the 1992 U.N. Framework Convention on Climate Change (FCCC) — include the "developed" nations and the former soviet economies; the U.S. is an Annex I Party. Each Annex I Party that has an assigned target for greenhouse gas emissions is listed, with its target, in Annex B of the Kyoto Protocol.

These "emissions trading" mechanisms offer the possibility that actual domestic greenhouse gas reductions will be less than the amount required to meet the U.S. commitment. If so, the impact of reductions will be different than if the U.S. met its full commitment through reducing emissions within its borders. The amount of reductions that can be shifted elsewhere is unclear, but nonetheless, may offer the possibility of avoiding some of the higher cost/higher impact reductions that otherwise would have occurred domestically. That the rules for "emissions trading" opportunities are not yet final and the ultimate share of reductions that might be shifted out of the country is uncertain adds a further degree of uncertainty in evaluating actual domestic reductions and their impacts.

Thus, while the emissions trading mechanisms of the Protocol do not reduce the emissions reduction that the U.S. would have to achieve, those mechanisms offer the opportunity to shift impacts of some of the reduction to other countries where, presumably, the costs (which would be borne by U.S. interests) may be less.

Reduction Uncertainties

Table 5 depicts the range of reduction requirements implied by the analyses reviewed above. As can be seen from **Table 5**, the projected reductions necessary by 2008-2010 to meet the Kyoto Agreement vary from over 30% (EIA's high economic growth scenario) to 21% (Interlaboratory Working Group's high energy efficiency case) below "business as usual" emissions. These high and low projections, which bracket the *Climate Action Report's* point estimate, differ only in assumptions about CO_2 emissions: the high projection is 16.7% higher than the low one; they vary from the *Climate Action Report's* by +11.7% to -4.3%.

Table 5. Projected 2010 Reduction Requirements to Achieve the Kyoto Accord

Projection	Projected Net Greenhouse Gas Emissions 2010 MMTCE	Kyoto Reduction Requirement	
		MMTCE	%
CAR	1,946	462	23.7
EIA			
High growth	2,141	657	30.7
Reference	2,061	577	28
Low Growth	1,971	487	24.7
IWG			
Business as Usual	1,974	510	25.6
Efficiency Case	1,874	390	21

None of the estimates integrates the full range of potential variables that could affect CO_2 emissions in the future — economic growth, electricity restructuring, electricity demand, and technological change and penetration. Thus these estimates do not include all the uncertainties about CO_2 emissions. And for net emissions, none of these estimates explore the uncertainties inherent in the baseline estimates and variables affecting projections of the other 5 greenhouse gases covered by the Kyoto Agreement. The likely impact of various uncertainties on future emissions/reduction needs is summarized in **Table 6**. In short, projecting future emissions and the amount that emissions might have to be reduced to comply with the Kyoto agreement is fraught with considerable uncertainty.

The reviewed estimates of the reduction necessary to meet the commitment — i.e., the reduction below "business as usual" emissions projected for 2008-2010 — range from approximately 390 to 660 MMTCE. Even ignoring numerous uncertainties, then, there remains a ~70% difference from the lower to higher reduction projected necessary to achieve the target. To comply with the higher compared to the lower estimate would represent a substantial escalation of effort and makes estimating potential costs difficult.[13]

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[13] Larry Parker and John Blodgett, *Climate Change: Three Policy Perspectives*, CRS Report 94-816 (1994).

Table 6. Selected Uncertainties in Projected Reduction Requirements

Variable introducing uncertainty	Impact on Future Greenhouse Gas Emissions/Reductions Required		
Baseline			
Baseline revised:			
upward	– [= less emissions, less reductions]		
down	+ [= more emissions, more reductions]		
Economic Assumptions for Projecting Emissions/Reductions in 2008-2010			
	Change from "business as usual"	EIA estimate MMTCE	IWG estimate MMTCE
Economic growth:			
higher than expected	+	+80	
lower than expected	–	– 90	
Energy Policy Assumptions			
Energy efficient technologies:			
adopted faster than expected	–	– 79	– 120
adopted slower than expected	+	+31	
Energy prices (e.g., electricity, gasoline):			
decline	+	+29	
rise	–		
Nuclear facilities retire:			
faster than expected	+	+15	
slower than expected	–	– 42	
Sinks			
Sinks:			
Human-induced sequestration drops	+		
Human-induced sequestration up	–		
Non-CO$_2$ Greenhouse Gases			
Netting all 6 greenhouse gases:			
Emission uncertainties narrow:			
higher than expected in 2010	+		
lower than expected in 2010	–		
HFCs, PFCs & SF$_6$ emissions:			
grow faster than expected	+		
grow slower than expected	–		
Emissions Trading			
"Emissions Trading" opportunities:	no change in emissions, but:		
Many opportunities taken	reduce domestic reductions/costs		
Few opportunities materialize	less reductions exported		

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Global Climate Change: Selected Legal Questions About the Kyoto Protocol

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Summary

On December 10, 1997, delegates from 161 nations concluded the Kyoto Protocol to the United Nations Framework Convention on Climate Change setting binding targets for reduction of emissions of greenhouse gases by developed nations. The Clinton Administration is generally supportive of the Protocol but will not sign it and submit it to the Senate for its advice and consent until further negotiations on the Protocol are held later this year. Nonetheless, a number of legal questions about the Protocol and its possible implementation have already arisen. This report adresses whether the United States is now legally bound by the Protocol, the legal implications of signing it, whether it could be implemented as an executive agreement without submission to the Senate, and whether the Protocol could be used as the legal basis for regulation of emissions even prior to ratification.

(1) Is the United States now legally bound by the Kyoto Protocol?

No. The Protocol has been negotiated, and the Administration has indicated its intent eventually to seek its ratification. But the Protocol has not as yet been signed by the U.S. or submitted to the Senate for its advice and consent, nor has it entered into force internationally. Both steps — ratification by the U.S. and entry into force internationally — are necessary for the Protocol to be legally binding on the U.S.

(2) What would be the legal effect of the United States signing the Kyoto Protocol?

The Kyoto Protocol provides that it is open for signature from March 16, 1998, to March 15, 1999, and is subject to ratification, acceptance, or approval.[1] As noted, the United States has not as yet signed the Protocol but Under Secretary of State Eisenstadt has stated that the Administration intends to do so sometime during this one year period.

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[1] Kyoto Protocol, Art. 23(1).

Signature in itself would not make the Protocol legally binding on the United States. But it would have at least two consequences. First, it would initiate the process by which the U.S. could become legally bound. That is, signature of a treaty is essentially a political statement of approval and represents "at least a moral obligation to seek (its) ratification."[2] Signature of the Protocol, thus, would be a public declaration of the Administration's intent to make it legally binding. That is only the first step in the process, however. The Protocol could not become legally binding until it is submitted to the Senate, the Senate gives its advice and consent, the President signs and deposits the appropriate instruments of ratification with the United Nations, and the Protocol gains sufficient ratifications to enter into force internationally.

Secondly, signature of a treaty or protocol obligates a state "to refrain from acts that would defeat the object and purpose of the agreement."[3] The Vienna Convention on the Law of Treaties, Art. 18, states the matter as follows:

> A State is obliged to refrain from acts which would defeat the object and purpose of a treaty when:
>
> (a) it has signed the treaty or has exchanged instruments constituting the treaty subject to ratification, acceptance or approval, until it shall have made its intention clear not to become a party to the treaty; or
>
> (b) it has expressed its consent to be bound by the treaty, pending the entry into force of the treaty and provided that such entry into force is not unduly delayed.[4]

The United States has not ratified the Vienna Convention but this portion likely represents customary international law on the subject.

As a practical matter, "[i]t is often unclear what actions would have such effect."[5] The *Restatement* suggests, however, that the irreversibility of an action may be an important criterion.[6]

(3) Could the Kyoto Protocol be treated as an executive agreement for which Senate or Congressional consent is not required?

Executive agreements are not mentioned as such in the Constitution, but their existence has been validated by historical practice and judicial decision.[7] Such agreements can generally be categorized as (1) congressional-executive agreements sanctioned by the joint authority of the President and the Congress, (2) agreements concluded pursuant to existing treaties, and (3) Presidential or "sole" executive agreements made by on the basis of the President's independent constitutional authority.

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[2] American Law Institute, *Restatement of the Foreign Relations Law of the United States Third*, Vol. 1 (1987), § 312, Comment d, at 173 (hereinafter *Restatement*).

[3] *Id.*, § 312(3).

[4] Vienna Convention on the Law of Treaties, Exec. L, 92d Cong., 1st Sess. (1971), Art. XVIII, *reprinted in* Congressional Research Service, *Treaties and Other International Agreements: The Role of the United States Senate*, 103d Cong., 1st Sess. (Comm. Print 1993), at 318, 334.

[5] *Restatement, supra*, Comment i, at 174.

[6] *Id.*

[7] *See Treaties and Other International Agreements, supra*, at 52-68.

The full scope of the President's authority to conclude and implement executive agreements remains a subject of scholarly debate, and the guidelines issued by the Department of State to direct whether a particular agreement should be in the form of a treaty or an executive agreement are suggestive but indeterminate.[8] But with respect to the Kyoto Protocol the issue appears to have been anticipated when the Senate gave its advice and consent to the Framework Convention on Climate Change in 1992.[9] During the hearing on the Convention the Senate Foreign Relations Committee propounded to the Administration the general question of whether protocols and amendments to the Convention and to the Convention's Annexes would be submitted to the Senate for its advice and consent. The Bush Administration responded as follows:

> Amendments to the convention will be submitted to the Senate for its advice and consent. Amendments to the convention's annex (i.e., changes in the lists of countries contained in annex I and annex II) would not be submitted to the Senate for its advice and consent. With respect to protocols, given that a protocol could be adopted on any number of subjects, treatment of any given protocol would depend on its subject matter. However, we would expect that any protocol would be submitted to the Senate for its advice and consent.[10]

The committee also asked more specifically whether a protocol containing targets and timetables for emissions reductions would be submitted to the Senate. The Administration responded:

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[8] In Circular 175, "Procedure on Treaties," the Department sets forth the following considerations to guide the decision whether a particular agreement is to be concluded as a treaty or an executive agreement:

a. The extent to which the agreement involves commitments or risks affecting the nation as a whole;

b. Whether the agreement is intended to affect State laws;

c. Whether the agreement can be given effect without the enactment of subsequent legislation by the Congress;

d. Past U.S. practice as to similar agreements;

e. The preference of the Congress as to a particular type of agreement;

f. The degree of formality desired for an agreement;

g. The proposed duration of the agreement, the need for prompt conclusion of an agreement, and the desirability of concluding a routine or short-term agreement; and

h. The general international practice as to similar agreements.

The Circular further provides that "[i]n determining whether any international agreement should be brought into force as a treaty or as an international agreement other than a treaty, the utmost care is to be exercised to avoid any invasion or compromise of the constitutional powers of the Senate, the Congress as a whole, or the President." *See Treaties and Other International Agreements, supra,* Appendix IV, at 301, 304.

[9] 138 CONG. REC. S 17156 (daily ed., Oct. 7, 1992).

[10] *Hearing Before the Senate Committee on Foreign Relations on the U.N. Framework Convention on Climate Change,* 102d Cong., 2d Sess. (1992), at 105 (Appendix).

> If such a protocol were negotiated and adopted, and the United States wished to become a party, we would expect such a protocol to be submitted to the Senate.[11]

The Senate did not attach any formal conditions to its resolution of ratification for the Convention. But the report of the Senate Foreign Relations Committee on the resolution stated as follows:

> The Committee notes that a decision by the Conference of the Parties to adopt targets and timetables would have to be submitted to the Senate for its advice and consent before the United States could deposit its instruments of ratification for such an agreement. The Committee notes further that a decision by the executive branch to reinterpret the Convention to apply legally binding targets and timetables for reducing emissions of greenhouse gases to the United States would alter the "shared understanding" of the Convention between the Senate and the executive branch and would therefore require the Senate's advice and consent.[12]

The committee made clear, in other words, its view that "[t]he final framework convention contains no legally binding commitments to reduce greenhouse gas emissions" and its intent that any future agreement containing legally binding targets and timetables for reducing such emissions would have to be submitted to the Senate. The Bush Administration concurred with that view and agreed to submit any such agreement. That commitment was cited during Senate debate on the resolution of ratification as an important element of the Senate's consent.[13] While these statements may not be as legally binding as a formal condition to the Senate's resolution of ratification for the 1992 Convention, it is doubtful that any administration could ignore them.

The Clinton Administration, it might be noted, has repeatedly stated that it intends to submit the Kyoto Protocol to the Senate for its advice and consent.

(4) Could the Kyoto Protocol, prior to ratification, be used as a basis for regulations imposing emissions restrictions on industry?

On rare occasion in the past treaties have been given provisional application prior to their ratification, *i.e.*, measures have been taken to carry them out even though they have not completed the ratification process. The Vienna Convention on the Law of Treaties states:

> 1. A treaty or a part of a treaty is applied provisionally pending its entry into force if:
>
> a. the treaty itself so provides; or
> b. the negotiating States have in some other manner so agreed.[14]

Most recently, for instance, the U.S. agreed to the provisional application of a revised deep seabed regime under the Law of the Sea (LOS) Convention. That Convention was put forward by the United Nations General Assembly as a multilateral treaty in 1982, but the U.S. chose not to sign it or to pursue ratification because of objections to the deep seabed regime set forth in Part XI. Part XI was subsequently renegotiated in the early part of this decade; and in order to allow the participation of industrial nations such as the U.S. which had not yet ratified the Convention in the policy making body for the deep seabed (the Council of the International Sea-Bed Authority), the agreement provided that it could be provisionally applied even before ratification. The U.S. voted in favor of the General Assembly resolution endorsing the Agreement revising Part XI,[15] subsequently signed the Agreement, submitted the LOS Convention as amended by the Agreement to the Senate for its advice and consent, and began participating in the initial implementation of the Agreement. However, the provisional application of the Agreement will, by its terms, terminate in November, 1998.

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[11] *Id.*, at 106.

[12] S. Exec. Rept. 102-55, 102d Cong., 2d Sess. (1992), at 14.

[13] *See* 138 CONG. REC. S 17150 (daily ed. Oct. 7, 1992) (statement of Sen. McConnell).

[14] Vienna Convention, *supra*, Art. 25.

A few other treaties have similarly been given provisional application — the Maritime Boundary Agreement between the United States and Cuba,[16] the Maritime Boundaries Agreement between the U.S. and Mexico,[17] the 1971 International Wheat Agreement,[18] and, arguably, the 1979 SALT II Treaty on the Limitation of Strategic Offensive Arms.[19] Nonetheless, the provisional application of a treaty remains an unusual occurrence.

For the U.S. the provisional application of a treaty "is in essence an executive agreement to undertake temporarily what the treaty may call for permanently."[20] According to the *Restatement*, such an executive agreement "normally must rest on the President's own constitutional authority"[21] but it also appears possible that that authority can be buttressed by Congressional or Senate authorization or approval, express or implied.[22]

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[15] GA Res. 48/263 (July 28, 1994).

[16] Exec. G, 96th Cong., 1st Sess. (1979). *See* Senate Exec. Rept. 96-49 (to accompany Execs. F, G, and H, 96-1) (1979). The treaty itself contained a provision providing that the maritime boundaries would be applied provisionally for up to two years pending ratification, and that provision has been renewed by a periodic exchanges of notes from the time of its signing in 1977 to the present.

[17] Exec. F, 96th Cong., 1st Sess. (1979). The maritime boundaries set forth in the treaty were identical to those in an executive agreement concluded in 1976, and the executive agreement provided that it would remain provisionally in effect "pending final determination by treaty of the Maritime Boundaries between the two countries. The Senate gave its consent to the treaty in October, 1997, and final ratification occurred in November. *See* 143 CONG. REC. S 11165 (daily ed. Oct. 23, 1997).

[18] *See Treaties and Other International Agreements, supra*, at 85.

[19] *Id.* Ratification of the treaty was forestalled by the Soviet invasion of Afghanistan, but both parties stated independently that they would observe the restraints of the treaty so long as the other party did so.

[20] *Id.*, at 84.

[21] *Restatement, supra*, Comment l, at 175.

[22] *Id. See also* Charney, Jonathan, "U.S. Provisional Application of the 1994 Deep Seabed

(continued...)

There does not appear to be any clear legal authority that might be invoked to sustain the provisional application of the Kyoto Protocol. Congress, for instance, has not assented to, or otherwise authorized, the provisional implementation of the Protocol either expressly or by implication. Indeed, Senate action in the summer of 1997 was expressly to the contrary. On July 25, 1997, the Senate unanimously adopted (95-0) a resolution expressing the view that the U.S. should not sign any agreement at Kyoto that would commit developed nations, but not developing ones, to reduce or limit greenhouse emissions by a certain date or that would do "serious harm" to the U.S. economy. The resolution further stated the view that any agreement which would require Senate advice and consent should be accompanied by a detailed analysis of its economic impact and of any legislation and regulations necessary to implement the agreement.[23] Moreover, the President's independent constitutional authority to impose such restrictions appears dubious. In *Youngstown Sheet & Tube Co. v. Sawyer*,[24] it might be noted, President Truman's claim of independent constitutional authority to take control of and operate the nation's steel mills to ensure continued production during the Korean War was rejected by the Supreme Court. In that instance the President claimed his action to be legally justified not only on the basis of an "inherent" power to protect the well-being and safety of the nation but also on the basis of the Commander-in-Chief and executive power clauses of Article II of the Constitution.[25] But the Court rejected his claims individually and in the aggregate, finding his actions to be a usurpation of the lawmaking power of Congress.

In sum, then, legal authority for the provisional application of a treaty must exist either in the independent constitutional powers of the President or in Congressional (or Senate) assent or authorization. In the present situation there does not appear to be any clear legal basis for the provisional implementation of the Kyoto Protocol prior to ratification and its entry into force.

This does not, however, mean that the United States is unable to adopt and implement measures that might parallel or support the obligations of the Kyoto Protocol. The Administration, for instance, has proposed a $6.3 billion climate change initiative as part of its budget for fiscal 1999, and Congress may choose to authorize and fund its implementation. But the legal authority for that initiative's implementation will be Congress' authorization, not the Kyoto Protocol.

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[22](...continued)
Agreement," 88 *Amer. J. Int. Law* 705 (1994) (arguing that Congressional participation in, and support for, the LOS Convention negotiations, the compatibility of the Agreement with the "Deep Seabed Hard Mineral Resources Act" adopted by Congress in 1988, and the authority given in the "State Department Basic Authorities Act" for temporary participation in international institutions support the provisional application of the Agreement).

[23] S.Res. 98, 105th Cong., 1st Sess., adopted at 143 CONG. REC. S 8138 (daily ed. July 25, 1997).

[24] 343 U.S. 579 (1952).

[25] Article II provides that "The executive Power shall be vested in a President" and that he "shall be Commander in Chief of the Army and Navy of the United States."

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Global Climate Change Treaty: The Kyoto Protocol

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Summary

Negotiations on the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) were completed December 11, 1997, committing the industrialized nations to specified, legally binding targets for emissions of six "greenhouse gases." The treaty will open for signature on March 16, 1998. The United States played a prominent role in these negotiations, and agreed to a target of reducing greenhouse gases by 7% below 1990 levels during a "commitment period" between 2008-2012. Because of the way sinks, which remove these gases from the atmosphere, are counted and because of other provisions discussed in this report, the actual reduction of emissions required to meet the target within the United States is estimated to be lower than 7%. The Administration has indicated that until developing countries also make commitments to participate in greenhouse gas limitations, it will not submit the protocol to the Senate for advice and consent, thereby delaying any possibility of ratification until at least after a November 1998 meeting of the parties in Buenos Aires, Argentina. At mid-year June 1998 meetings of the UNFCCC subsidiary bodies, a number of the more difficult issues were discussed, but results of these meetings were generally inconclusive. In Congress, several committees have held hearings on the Kyoto Protocol and its implications, and a number of bills, resolutions and provisions in appropriations bills have been introduced or considered, mostly to limit activities of the U.S. government that are or could be seen as related to carrying out the goals of the Kyoto Protocol.

Background

Responding to concerns that human activities are increasing concentrations of "greenhouse gases" (such as carbon dioxide and methane) in the atmosphere, most nations of the world joined together in 1992 to sign the United Nations Framework Convention on Climate Change (UNFCCC). The United States was one of the first nations to ratify this treaty. It included a legally non-binding, voluntary pledge that the major industrialized/developed nations would reduce their greenhouse gas emissions to 1990 levels by the year 2000. However, as scientific consensus grew that human activities are having a discernible impact on global climate systems, possibly causing a warming of the Earth that could result in significant impacts such as sea level rise, changes in weather patterns and health effects—and as it became apparent that major nations such as the United States and Japan would not meet the voluntary stabilization target by 2000—Parties to the treaty decided in 1995 to enter into negotiations on a protocol to establish legally binding limitations or reductions in greenhouse gas emissions. It was decided by the Parties that this round of negotiations would establish limitations only for the developed countries (those listed in Annex I to the UNFCCC, including the former Communist countries, and referred to as "Annex I countries"; developing countries are referred to as "non-Annex I countries").[1]

During negotiations that preceded the December 1-11, 1997, meeting in Kyoto, Japan, little progress was made, and the most difficult issues were not resolved until the final days—and hours—of the Conference. There was wide disparity among key players especially on three items: (1) the amount of binding reductions in greenhouse gases to be required, and the gases to be included in these requirements; (2) whether developing countries should be part of the requirements for greenhouse gas limitations; and (3) whether to allow emissions trading and joint implementation, which allow credit to be given for emissions reductions to a country that brings about the actual reductions in other countries or locations where they may be cheaper to attain.

The United States proposal was for a reduction in all six major greenhouse gases to 1990 levels by the period 2008-2012, with joint implementation allowed. The European Union (EU) argued strongly for a 15% reduction from 1990 levels by 2010 for three greenhouse gases, using a "bubble," or cumulative, approach for the nations within the EU, but no joint implementation beyond that. Japan proposed a 5% reduction from 1990 levels for three greenhouse gases. The group of developing countries (known as the G77) proposed that developed countries should stabilize their emissions of greenhouse gases at 1990 levels by 2000, then reduce them by 15% by 2010, with further reductions of 20%—for a total of 35% reduction by 2020 below 1990 levels.

Following completion of the Protocol in December of 1997, details of a number of the more difficult issues remained to be negotiated and resolved (see below). Some of these were taken up at June 2-12, 1998 meetings of the subsidiary bodies of the FCCC on implementation and scientific and technical affairs. These discussions were generally inconclusive, and consideration and work on the details of these unresolved concerns continues. Formal discussion and negotiation will resume at the COP-4 meeting in November in Buenos Aires, Argentina.

Summary of the Kyoto Protocol to the UNFCCC

The Kyoto Protocol was completed in haste during an extension of the Kyoto meeting beyond its December 10 deadline, into the morning of December 11. It contains a number of areas for which details will have to be worked out over the next year. The

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[1] For additional information on the negotiations in Kyoto and related background, see CRS Report 97-1000, *Global Climate Change Treaty: Negotiations and Related Issues*; and CRS Issue Brief 89005, *Global Climate Change*.

Protocol opened for signature March 16, 1998, and will enter into force when 55 nations have ratified it, provided that these ratifications include Annex I Parties that account for at least 55% of total carbon dioxide emissions in 1990. At the end of July, 38 countries had signed the treaty, including the European Union and most of its members, Canada, Japan, China, and a range of developing countries.

The major commitments in the treaty on the most controversial issues are as follows:

Emissions Reductions. The United States would be obligated under the Protocol to a reduction of 7% below 1990 levels for three greenhouse gases (including carbon dioxide), and below 1995 levels for the three man-made gases, averaged over the commitment period 2008 to 2012. The Protocol states that Annex I Parties are committed—individually or jointly—to ensuring that their aggregate anthropogenic carbon dioxide equivalent emissions of greenhouse gases do not exceed amounts assigned to each country in Annex B to the Protocol, "with a view to reducing their overall emissions of such gases by at least 5% below 1990 levels in the commitment period 2008 to 2012." Annex A lists the 6 major greenhouse gases covered by the treaty[2].

Annex B lists 39 nations, including the United States, the European Union plus the individual EU nations, Japan, and many of the former Communist nations. The amounts for each country are listed as percentages of the base year, 1990 (except for some former Communist countries), and range from 92% (a reduction of 8%) for most European countries—to 110% (an increase of 10%) for Iceland. The United States is committed on this list to 93%, or a reduction of 7%, to be achieved as an average over the five years 2008-2012.

Based on projections of the growth of emissions using current technologies and processes, the reduction in greenhouse gas emissions required of the United States would likely be between 20% and 30% below where it would be otherwise by the 2008-2012 budget period.[3] However, according to Administration officials, based on the accounting method adopted in the Protocol, which includes (as the United States had urged) greenhouse gas sinks, it appears that the actions that must be taken in to reduce emissions within the United States, after sinks are counted, would be substantially less than 7%—probably in the range of 2 to 3%. The Administration also is assuming that a significant portion of its 7% target could be met through some combination of emissions trading and joint implementation.

Developing Country Responsibilities. The United States had taken a firm position that "meaningful participation" of developing countries in commitments made in the Protocol is critical to approval of the treaty by the U.S. Senate, and it argued that success in dealing with the issue of climate change and global warming would require such participation. The developing country bloc argued that the Berlin Mandate—the terms of reference of the Kyoto negotiations—clearly excluded them from new commitments in this Protocol, and continued to oppose emissions limitation commitments by non-Annex I countries. The negotiations concluded without such commitments, and the United States indicated that it will not submit the Protocol for Senate consideration—and therefore will not ratify it—until subsequent negotiations are held and meaningful commitments are made by developing countries. The next meeting of the Parties will be in November 1998 in Buenos Aires, Argentina, and may provide the first formal opportunity for this issue to be revisited, although it is not clear yet whether or how it would be put on the agenda for that meeting.

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[2] The six gases covered by the Protocol are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). The most prominent of these, and the most pervasive in human economic activity is carbon dioxide, produced when wood or fossil fuels such as oil, coal, and gas are burned.

[3] See CRS Report 98-235 ENR, *Reducing Greenhouse Gases: How Much from What Baseline?*

The Protocol does call on all Parties—developed and developing—to take a number of steps to formulate national and regional programs to improve "local emission factors," activity data, models, and national inventories of greenhouse gas emissions and sinks that remove these gases from the atmosphere. All Parties are also committed to formulate, publish, and update climate change mitigation and adaptation measures, and to cooperate in promotion and transfer of environmentally sound technologies and in scientific and technical research on the climate system.

Emissions Trading and Joint Implementation. Emissions trading, in which a Party included in Annex I "may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases" for the purpose of meeting its commitments under the treaty, is allowed and outlined in Article 6, with several provisos. Among the provisos is the requirement that such trading "shall be supplemental to domestic actions." The purpose of this proviso is to make it clear that a nation cannot entirely fulfill its responsibility to reduce domestic emissions by relying primarily on emissions trading or joint implementation to meet its targets. A number of specific issues related to the rules on how joint implementation and emissions trading will work are to be negotiated and resolved in subsequent meetings, as these issues are clarified and identified. In the months since the Protocol was completed, it has become increasingly clear that this is an extremely complex issue, and an emissions trading system is not likely to be designed and implemented quickly.

A major development is the establishment of a "clean development mechanism" (CDM), through which joint implementation between developed and developing countries would occur. The United States had pushed hard for joint implementation, and early proposals were formulated with the expectation that "JI" projects would be primarily bilateral. Instead, negotiations resulted in agreement to establish the clean development mechanism to which developed Annex I countries can contribute financially, and developing non-Annex I countries can benefit from financing for approved project activities; Annex I countries can then use certified emission reductions from such projects to contribute to their compliance with part of their emission limitation commitment. Emissions reductions achieved through this mechanism can begin in the year 2000 to count toward compliance in the first commitment period (2008-2012). Again, proposals on how this mechanism will operate will be developed and, presumably, discussed at the November 1998 Conference of the Parties. Like emissions trading, making the CDM operational appears likely to be a protracted and difficult process, given the increasing number of complexities emerging from the on-going work and discussions on how the CDM might work.

Issues for Congress

Ratification. For the United States to ratify the Protocol, the treaty must be submitted to the U.S. Senate for advice and consent. Ratification requires a two-thirds majority vote in the Senate for approval. Unless the United States ratifies the treaty, it will not be subject to its terms and obligations. President Clinton has voiced strong support for the Kyoto Protocol, and the United States is expected to sign it, although it is not clear when. However, in recognition of the opposition expressed in the Senate by S.Res.98, which passed 95-0, to a Protocol that does not include requirements for emissions limitations by developing countries, the President has indicated that he will not submit the treaty to the Senate for advice and consent until additional negotiations have provided for meaningful developing country participation. The next Conference of the Parties that would offer an opportunity to make such provisions will be in November 1998 in Buenos Aires. Thus it seems unlikely that the treaty will be submitted to the Senate until after that time.

Oversight. Both the House and Senate sent delegations of Members to serve as observers on the U.S. delegation to the Kyoto meeting. Supporters and opponents of the Protocol were included in these delegations. A number of committees have held hearings on the implications of the Protocol for the United States, its economy, energy prices, impacts on climate change, and other related issues.[4] While the Administration has stated that it believes the treaty can be implemented without harm to the U.S. economy, and without imposing additional taxes, a number of questions related to how its goals can be achieved are likely to arise in hearings during the year ahead.

Legislation. When a treaty is sent to the Senate for consideration, legislation that might be required for its implementation is also typically sent to the Congress. Such legislation is not likely in the near future, certainly not until the end of 1998, or until the treaty is sent to the Senate. However, the President's proposal on climate change, announced in October, included, among other things, a $5 billion package of tax credits and spending on research and development over 5 years to encourage energy efficiency and development of new lower emission technologies. In the President's budget proposals, he offered an initiative over multiple years of $6.3 billion dollars for research and development and some possible tax incentives. A number of legislative proposals—including bills, resolutions, and provisions in several appropriations bills—express concerns related to the Kyoto Protocol. Many of these would limit activities of the U.S. government that might be seen to advance the goals of the Kyoto Protocol prior to its consideration by the Senate.[5]

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[4] Congressional hearings are discussed in the CRS electronic briefing book on Global Climate Change at http://thomas.loc.gov/brbk/html/ebgcccon.html

[5] See CRS Issue Brief 89005: Global Climate Change. Another source for a listing of legislation and its status, and other information about the Kyoto Protocol and other climate change concerns and reports, is the CRS electronic briefing book on Global Climate Change on the CRS Home Page at: http://thomas.loc.gov/brbk/html/ebgcctop.html

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CRS Report for Congress

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Global Climate Change: Congressional Concern About "Back Door" Implementation of the 1997 U.N. Kyoto Protocol

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Summary

Adopted in December 1997, by parties to the 1992 U.N. Framework Convention on Climate Change (FCCC), the [Kyoto] Protocol would require legally binding regulations on greenhouse gas emissions for most industrialized countries, if it enters into force (EIF). EIF requires 55 countries, representing at least 55% of global emissions of carbon dioxide (CO2), to deposit an instrument of ratification with the U.N. FCCC Secretariat. The U.S. Senate has not yet had an opportunity to consider advice and consent to ratification of the Kyoto Protocol because the Clinton Administration is trying to modify the agreement to align it, in principle, with **S.Res. 98**, the Byrd/Hagel resolution of July 1997. S.Res.98, expressed the Senate's views regarding international regulation of greenhouse gas emissions, and stipulated that the Senate would not ratify any international treaty that does not include commitments which are comparably stringent for all FCCC parties, including developing countries which the Kyoto Protocol subsequently has exempted.

In addition to S.Res.98, **H.R. 3807** and some FY1999 appropriations bills have been used as vehicles for explicit congressional direction to the executive branch about possible "back door" implementation of the Kyoto Protocol; that is, implementation without Senate ratification. Also, in some of the appropriations reports Congress raises the question of whether the Environmental Protection Agency (EPA) has authority to regulate greenhouse gases in the face of congressional direction not to promulgate or implement further regulations without the force of legislation such as that contained in H.R. 3807. Also, Congress addresses federal research funding for climate change in these reports and questions its efficacy and benefits for the American taxpayer.

Discussion of legislation relating to global climate change, may be found in the CRS Issue Brief on Global Climate Change: IB89005, updated regularly, or in the Legislation section of the CRS Electronic Briefing Book for Congress on Global Climate change at **http://lcweb.loc.gov/crs**. This report will be updated as needed.

Background

Certain legislation in the 105th Congress, and appropriations bills for FY1999 reported in the House and in the Senate, address issues of what some Members of Congress regard as a possible premature implementation of requirements of the U.N. [Kyoto] Protocol on Climate Change through the "back door." The Kyoto Protocol, if it enters into force, would require new regulatory action by the United States, and other industrialized countries, on greenhouse gases. Congress is concerned that some form of implementation might occur prior to deliberation by the Senate for advice and consent to its ratification. Other issues relate to climate change research, its funding, and President Clinton's request for $6.3 billion for a Climate Change Technology Initiative (CCTI)[1] for the Department of Energy. Such issues have also prompted congressional direction in these measures. For example, Congress has asked for clarification on whether funding for existing federal programs that have been previously authorized can be construed as contributing to, or "contemplating,"the implementation of the Kyoto Protocol. Relative to this debate is whether the Environmental Protection Agency (EPA) currently has the authority to regulate the emissions of greenhouse gases implicated in projections of future global warming. Still other issues raised include whether funding at scientific agencies for global climate change research is being directed to enhance knowledge about global climate change or to fund studies that attempt to advance a specific policy agenda, and whether funding agencies can demonstrate a return on such investments in compliance with the Government Performance and Results Act (GPRA).[2]

The first bill introduced in the 105th Congress to address a possible attempt by the Clinton Administration to implement elements of the Kyoto Protocol prior to advice and consent of the Senate was **H.R. 3807**, the "American Economy Protection Act." This measure was introduced on May 7, 1998, by Rep. Knollenberg, and was referred to the House Committee on Commerce and, later, its Subcommittees on Energy and Power and Health and the Environment on May 26, 1998. Other bills of similar intent have been introduced in both the House and the Senate since (See Legislation, in IB89005, *Global Climate Change*, updated regularly).

H.R. 3807 addresses two major areas: (1) federal funding to directly or indirectly implement the Kyoto Protocol and, (2) granting of authority to any U.S. agency to regulate emissions of carbon dioxide (CO2). It is important to note at the outset that H.R. 3807 does not expressly preclude federal funding for the United States to carry out its responsibilities and commitments under the 1992 U.N. Framework Convention on Climate Change (FCCC). H.R. 3807 is concerned only with implementation of the Kyoto Protocol, adopted by the parties to the Convention in December 1997 in Kyoto, Japan. The Kyoto Protocol is an international regulatory instrument related to, but separate in force of law from, the FCCC.

The first theme of H.R. 3807 is recognition that federal funds have been appropriated in budgets of such agencies as the U.S. Department of Energy and the Environmental

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[1] For more information on the President's Climate Change Technology Initiative (CCTI), see CRS report 98-408, 27 April 1998.

[2] For more information on GPRA, and Congress's role in its implementation, see CRS Report 98-1028, updated periodically.

Protection Agency, and for the interagency U.S. Global Climate Change Research Program (USGCRP). Funds have been authorized under such legislative vehicles as P.L. 102-486, the 1992 Comprehensive National Energy Policy Act, or EPACT, to conduct among other things research on energy efficiency and energy saving or conserving technology, some of whose results might have a primary or secondary outcome of reducing carbon dioxide and, possibly, other greenhouse gas emissions. Also, as noted, the United States is currently party to the 1992 U.N. Framework Convention on Climate Change (FCCC), for which the U.S. Senate gave advice and consent to ratification in October 1992. Among commitments for industrialized countries under the FCCC, which includes the United States, is one that calls for those parties to support research into ways to reduce greenhouse emissions at their source or to improve means for sequestering carbon dioxide through enhancement of "sinks" (forests, vegetation, and land-use practices) — all within the context of the Convention's non-binding aim of stabilizing greenhouse gas emissions at 1990 levels by the year 2000.

On July 31, 1997, the Senate passed **S.Res. 98**, the Byrd/Hagel Resolution, that expressed the sense of the Senate regarding *new commitments* for the United States under international climate change agreements. S.Res. 98 signaled the executive branch that developing country commitments under the Kyoto Protocol should be no less stringent than those of industrialized countries, in the view of the Senate, and that developing country parties also should be subject to legally binding emissions reductions within the same time-frame as industrialized countries. H.R. 3807 references this language in its Findings section, 2(5)(A).

H.R. 3807 states that the Senate unanimously voted that any new commitments to limit or reduce greenhouse gas emissions of the United States must include scheduled commitments for developing country parties to limit or reduce greenhouse gases emissions, and in principle, recognizes that the United States and other industrialized countries have existing commitments (voluntary stabilization of greenhouse gases at 1990 levels by the year 2000) under the FCCC. What is different about the Kyoto Protocol for the United States is that it goes beyond the FCCC to require *legally* an emissions reduction of an average of 7% below 1990 levels between the years 2005-2012. That agreement would represent a new (and more stringent) commitment for the United States, subject to advice and consent of the U.S. Senate. Moreover, entry into force of the Kyoto Protocol would mean new commitments for most industrialized countries under FCCC, but not necessarily for developing countries.

In the spirit of S.Res. 98, Section 3 of H.R. 3807 stipulates that no funds shall be used for rules, regulations, or programs to implement, *or in contemplation of implementing the Kyoto Protocol.* The term "...or in contemplation of..." appears problematic. New rules relating to greenhouse gases promulgated by the EPA might be judicially challenged as "contemplating" Kyoto requirements whether or not it was true. Definition of this term might then be determined by a court. Questions could also arise as to how this language applies to existing programs. For example, would this apply to the Department of Energy's research and development programs in energy conservation and renewable energy, which are already funded but that might, in the long run, be interpreted as contributing to the ability of the United States to meet future emissions reductions goals under the Kyoto Protocol, if it enters into force?

The second major theme of this bill addresses U.S. government authority, or lack thereof, to regulate carbon dioxide emissions through existing law. Carbon dioxide (CO2) is not identified as a criteria pollutant under the U.S. Clean Air Act, and is therefore not regulated by the federal government as such. (Criteria pollutants are those determined to adversely affect human health.) EPA does have the authority to identify new substances that might be determined to be criteria pollutants. However, some believe that CO2 should be regulated because of its potential contribution to climate change, which has not been determined to adversely affect human health. H.R.3807 appears to effectively bar regulatory actions without new legislation. This provision may be a controversial one.

FY1999 Appropriations Bill Report Language

Reflecting themes raised in H.R. 3807, and other global climate change issues, specific direction has emerged in some report language accompanying House and Senate versions of bills that fund the federal government and its programs. The greatest attention seems to have been focused on programs authorized at the Department of Energy for energy conservation, nuclear and renewable energy, and on the request for new funding for President Clinton's Climate Change Technology Initiative (CCTI). Also, in these reports, Congress in exercising its authority for oversight of government programs and is reviewing whether funding for global climate change research is being spent as it has authorized, and whether the American taxpayer is receiving returns on its investments in scientific research, as now required by GPRA.

Energy and Water Development Appropriations Bill, 1999 (H.R. 4060).Title III-Department of Energy, Energy Supply, H.Rept. 105-581, June 16, 1998. The Committee questioned the premise of the Administration's request to increase spending for programs it identifies as part of the Climate Change Technology Initiative (CCTI), specifically considering how FY 1998 appropriations have been managed and spent with respect to global change research. With respect to the Science section in the DOE budget, the Committee recommended cutting the Office of Energy Research request for CCTI of $27 million in half, citing that half of the funding to date has been spent on policy and half on science. Funding would be authorized to publish materials on the understanding of the underlying science and complexities of climate change, not policy-related materials. In the Departmental Administration section of this report, the Committee instructed that $13.5 million of CCTI funding intended for policy-related research be transferred to the Basic Energy Sciences and Biological and Environmental Research Program.

Department of Interior and Related Agencies Appropriations Bill, 1999 (H.R. 4193) H.Rept. 105-609, July 8, 1998. In comparing committee recommendations with the Administration budget request, the Committee notes that the Administration focused much of its proposed budget increase on the Department of Energy programs, including global warming/climate change programs. The Committee does not agree to fund those programs in the absence of any international agreements. Under Related Agencies, Fossil Energy Research and Development, Provision 9, it states that no funds are to be used to implement the Kyoto Protocol, as does provision 28 under Energy Conservation. In an addendum to this report entitled, "Additional Views of Hon. David R.Obey," it states that, "Many other ... funding levels in the bill are woefully inadequate ...Virtually none of the Administration's ... Climate Change Technology Initiative was funded."

Department of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Bill, 1999 (H.R. 4194). Title III-Environmental Protection Agency. H.Rept. 105-610, July 8, 1998. Climate change research in EPA would be funded at $26.9 million, an increase of $10 million above FY 1998 levels. The Climate Change Technology Initiative would receive $72.5 million, identical to FY1998 funding. H.R. 4194 includes language which limits expenditures for certain activities relative to the Kyoto Protocol, and specifically prohibited funds to implement the Kyoto Protocol in any manner until it has been ratified by the Senate. The Committee states that "the White House Council on Environmental Quality (CEQ), among others, may be engaging in activity that is tantamount to lobbying in an effort to build public support for implementation of the Protocol, and that there is a fine line between education and advocacy of an issue." EPA and CEQ thus are directed to refrain from conducting educational outreach or informational seminars on policies underlying the Kyoto Protocol until or unless the Protocol is ratified by the Senate. In an addendum to this report entitled, "Additional Views of Hon. David. R. Obey," it states that,

> Although proponents of the provisions will undoubtedly say that the intent of the [bill] language is only to prohibit implementation of the Kyoto Protocol until ratification of a treaty by the United States Senate, the effect of the provisions would be much greater. The EPA has ongoing activities to develop and issue regulations—under existing statutory authorities—that would be affected by the Kyoto provisions. Furthermore, the report language is too extreme. Its effect is to prohibit the Administration from providing information or educating the public on the "policies underlying the Kyoto protocol." ... [W]hatever the facts, the government in general, and the Congress in particular should not stifle a full discussion of an issue with such potential import... Once again, there are many ongoing Administration activities with separate existing legal authorities that could be construed by some as "underlying the Kyoto Protocol". Thus, such language invites both confusion and confrontation.

Energy and Water Development Appropriation Bill 1999 (S. 2138). Title III-Energy Supply, Solar and Renewable Energy. S.Rept. 105-206, June 5, 1998. The report acknowledges S. 2138 as the first appropriations bill since "signing the Kyoto Global Climate Change Accord." Report language questions the Administration's methodology in selecting 1990 as baseline for emission reductions, and recommends that historical concentrations rather than annual production rates be used, citing climate implications of the former. Questions are raised regarding Kyoto Protocol effectiveness at reducing atmospheric concentrations of carbon dioxide and other greenhouse gases. The Committee reports they would fund low-emissions technology (solar, renewable, nuclear) currently undeveloped but anticipated to be implemented by the year 2010.

Department of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Bill, 1999 (S.2168). U.S. Environmental Protection Agency (EPA) Funding. S.Rept. 105-216, June 12, 1998. The Committee would reduce Climate Change Technology Initiative funding by $10 million and redirect that amount to the Partnership for a New Generation of Vehicles (PNGV). Also, it would reduce funding for the Global Observation and Learning to Benefit the Environment (GLOBE) program by $ 1 million. The report acknowledges the President's October 1997, 3-staged proposal for reducing U.S. greenhouse gas emissions, and requests a detailed plan including annual performance goals by December 1998, that documents compliance with and determines effectiveness of implementing international climate change agreements negotiated on behalf of the United States, to comply with GPRA. Report language also promotes funding of international collaborations in arctic research related to global change.

Department of Interior and Related Agencies Appropriations Bill, 1999 (S. 2237). S. Rept. 105-227, June 26, 1998. The report states that the Summary section of the bill under "Climate Change Research," justifies programs already funded associated with issues of domestic energy production, national energy security, energy efficiency and costs savings, related environmental assessments, and general energy emissions improvements. Report language directs that no funds be used to implement actions called for "solely" under the Kyoto Protocol, prior to its ratification. The Committee recognizes long-standing energy research programs that "have goals and objectives which, if met, could have positive effects on energy use and the environment." The Committee states that "future funding requests would require that the Administration justify additional funding as being independent of the goals of implementation of the Kyoto Protocol." **Title II- Related Agencies, Department of Energy**, instructs the Administration to comply with Government Performance and Results Act (GPRA) with respect to justifying a national plan for climate change under the Kyoto Protocol and to prepare a detailed report on how key elements of the President's proposal would be implemented, addressing in that report performance measures that demonstrate effectiveness of the Administration's meeting intended emissions reduction goals, and betterment of the environment. The Committee requires the President's plan be reported in conjunction with the fiscal year 2000 budget submission for the Department of Energy to Congress.

Conclusion

H.R. 3807 seems to be key legislation in the 2nd session of the 105th Congress that addresses a possible "back door" implementation of the Kyoto Protocol, and it is currently under review by two Subcommittees of the House Committee on Commerce. Some congressional appropriations bills for FY1999, and accompanying reports, related to issues addressed by H.R. 3807, are being subjected to close scrutiny owing to what some Members have characterized as an unclear understanding and possible ambiguity of some language contained in that bill. At the root of this debate, is whether EPA and other executive branch agencies have the authority under existing law to issue rules addressing global climate change and its impacts, or whether that direction has to come by means of new legislation enacted by Congress. For example, some believe carbon dioxide should be regulated as a greenhouse gas, and this is also a requirement of the Kyoto Protocol. As a consequence, concerns have been raised as to whether certain provisions of the Clean Air Act, or other U.S. laws, might allow for implementing provisions of the Kyoto Protocol without Senate ratification. Another issue raised in some appropriations reports is whether global climate change research is being funded by agencies as authorized by Congress, that is, for scientific research for a better understanding of climate change, or rather to promote Administration policy, be that either developing means to mitigate or educating the American public on possible adaptation strategies for uncertain climate change.

Resources for the Future Documents

The Kyoto Protocol on Climate Change

BACKGROUND, UNRESOLVED ISSUES AND NEXT STEPS

J.W. Anderson

RESOURCES
FOR THE FUTURE

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This paper is a revised and expanded version of *Climate Change, Clinton and Kyoto: The Negotiations Over Global Warming*, issued November 1997.

Resources for the Future (RFF) is an independent, nonprofit research organization that aims to help people make better decisions about the conservation and use of their natural resources and the environment. For the past 45 years, researchers at RFF have conducted environmental economics research and policy analysis involving such issues as forests, water, energy, minerals, transportation, sustainable development, and air pollution. They also have examined, from a variety of perspectives, such topics as government regulation, risk, ecosystems and biodiversity, climate, hazardous waste management, technology, and outer space.

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WHEN THEY MET in Rio de Janiero in 1992, the world's governments agreed to try to stabilize emissions of the gases that can change the climate. But it was an agreement only to make a voluntary effort, with no binding commitments and no penalties for countries that failed to meet their goals.

When the same governments met again in Kyoto last December, they were attempting a much more difficult feat. They undertook to negotiate a binding agreement to firm and specific limits on greenhouse emissions in at least the world's major economies.

As the Kyoto Protocol to the Rio Treaty emerged on Dec. 11, it was a success in the sense that it represented a solid consensus of the 159 governments represented at the conference. But it was only a partial success, for it achieved that consensus by avoiding, or deferring to future conferences, a number of issues that would be crucial to its operation generally, and to its ratification by the country producing the greatest emissions, the United States. (For analysis of the Kyoto Protocol, see pages 14 to 18 of this paper.)

The Rio treaty had set the aim of lowering emissions to the 1990 level by the year 2000. By the Kyoto meeting, five and a half years later, it was clear that only a few countries would achieve that reduction. In the meantime, accumulating scientific evidence tended to support the proposition that gases resulting from human activity were already changing the global climate. This evidence is not conclusive and much controversy continues among researchers, but it is fair to say that by 1997 most scientists considered it at least probable that rising concentrations of these gases in the atmosphere were having an impact on temperatures and weather patterns.

Since greenhouse gases are generated mostly by burning fossil fuel, as in power plants, factories and automobiles, it is not easy to reduce emissions in growing economies. With the Kyoto conference, the concept of limiting emissions has become a political issue in many of the industrial countries. Here in the United States, ratification of the Protocol will require a two-thirds vote in the Senate. On one side are fears that emissions limits will interfere with economic growth and the rise in standards of living. On the other are fears, expressed by President Clinton and Vice President Gore among others, that global warming will mean bizarre weather with disastrous flooding, droughts and epidemics.

Climate change is an unusually difficult issue for the people who make the decisions in democratic governments. First of all, the science is uncertain while governments have to make firm policy decisions — if only the decision to do nothing — long before these uncertainties can be resolved. Political leaders are already beginning to overstate the clarity of the science, in order to attract public support. A lot of money is now going into climate research, and new findings with varying political implications will continue to appear.

Any serious attempt to cut emissions will have clear and immediate costs, but the benefits may not appear for a long time. To the extent that the benefits may be disasters that didn't happen, they may never be obvious. But the costs will be. As the debate develops, much of it is being cast in terms of the restraint that the present generation owes to future generations.

The Negotiating Record Up to 1996

Climate change is a newcomer to the international political agenda, having emerged as a major policy issue only in the late 1980s. But scientists have been working on the subject for decades.

They have known since the 19th century that carbon dioxide (CO_2) in the atmosphere retains heat from the sun, and that temperatures on the Earth's surface are affected by it. CO_2 is generated by burning any fuel containing carbon, from coal and oil to wood and cow dung. With the industrial revolution, the world's consumption of these fuels has increased hugely.

For many years scientists ignored it because, they assumed, the increases in CO_2 were being absorbed by the oceans. But in the International Geophysical Year 1957-58, they decided to test that assumption with a series of measurements from the top of Mauna Loa, the Hawaiian volcano, chosen as a site far removed from the influence of any local smokestacks. The Mauna Loa readings quickly demonstrated that concentrations of CO_2 in the atmosphere were rising steadily.[1]

That finding led to a series of scientific meetings, most of them organized by various United Nations agencies. Concern about the climate was reinforced by a number of events, particularly the devastating drought along the southern rim of the Sahara Desert. As these meetings continued, scientists began to realize that in addition to CO_2, other common gases could also affect climate. Methane was one example, nitrous oxide another.

Until the mid-1980s, in most countries, environmental policy had been focused on domestic action. The most obvious threats were at home and, in any case, in the context of the Cold War any serious international cooperation to curtail greenhouse gas emissions seemed unlikely. But attitudes began to change around 1985, as scientists warned their governments about the ozone layer. Ozone in the stratosphere, they said, formed a screen that blocked ultraviolet radiation that can cause skin cancers in humans. Chlorofluorocarbons, a class of manufactured gases widely used in refrigeration and air conditioning, were escaping into the upper atmosphere where they were eating holes in the ozone layer. In response, the governments of most of the industrial countries negotiated the Montreal Protocol of 1987 to restrict, and ultimately to ban altogether, the production of these gases. The success of international cooperation at Montreal greatly encouraged the prospect for similar cooperation on other environmental policies. The end of the Cold War then removed another longstanding impediment.

The year 1988 is the point at which climate change and global warming emerged as a major political issue throughout the industrial countries. In the United States, Sen. Timothy Wirth (D-Colorado) had been deeply exasperated by his inability to draw public attention to the subject. When summer arrived he waited for a day forecast to be spectacularly hot, and called a hearing at which several experts testified. With the temperature at 98 degrees and anxiety rising about the drought gripping the Midwest and South, one of the experts, James E. Hansen, told the senators that the world was warmer than at any time in this century. It was 99 per cent certain, he continued, that the cause was man-made gases and not natural variation. "It is time to stop waffling so much and say the evidence is pretty strong that the greenhouse effect is here," he told a reporter for the New York Times, which put the story at the top of page one.

Hansen's testimony had unusual force because he was director of the National Aeronautics and Space Administration's Institute for Space Studies, and the first scientist of that stature to declare flatly that the rising temperatures were related to burning fuel.

Four days later a conference opened in Toronto, attended by several hundred scientists, politicians and officials from 48 countries and the UN. It started the push for action by calling for a 20 per cent reduction in CO_2 emissions by the year 2005. Political leaders in several countries picked up the issue. One of them was Margaret Thatcher, the prime minister of Great Britain, who had been trained in chemistry as an undergraduate. In December the UN's General Assembly approved the establishment of an Intergovernmental Panel on Climate Change (IPCC) to review the science.

The following year at their annual summit meeting, the heads of the seven big industrial democracies' governments called for a treaty —a framework convention, as it became known — to limit the world's production of CO_2. Negotiations shortly got under way.

But strains between the United States and most of the western European countries soon became visible. The Bush administration was uneasy about the scientific base for policy, and wanted more time for research. It was also hearing from industries threatened by the prospect of limitations on fuel consumption. The Europeans wanted to begin to move immediately. In early 1990 Bush held a White House conference attended by most of the industrial countries, where this dispute was ventilated but not resolved.

Later in 1990 the first IPCC reports appeared, demonstrating a broad consensus among scientists in the field that the possibility of global warming at least had to be taken seriously. If warming had not yet started, the IPCC said, continuing increases in concentrations of greenhouse gases would certainly lead to it sooner or later. The Europeans cited the warnings in the report, while the Bush administration pointed to the uncertainties.

Throughout a long series of negotiating sessions, the United States flatly opposed any firm targets for CO_2 reduction in the emerging Framework Convention on Climate Change. The Europeans pushed and pulled vigorously, but got nowhere. In its final form the text gave them half a loaf, by acknowledging the desirability of reductions and setting the voluntary goal of cutting CO_2 emissions back to the 1990 level by the year 2000. Although that goal was merely an aspiration with no firm commitment or means of enforcement, it represented substantial movement from the United States's original inclination to do no more than study the situation. The text of the Framework Convention was completed in time to be signed with great ceremony by nearly every country on Earth at the UN's huge and colorful Conference on Environment and Development in Rio de Janiero in June 1992.

The 1992 elections brought to Washington an administration more sympathetic to action on environmental issues than its predecessor. It immediately signaled its intention of moving away from the Bush administration's position, and in February 1993 President Clinton proposed a broad tax on all energy consumption. It became known as the BTU tax, since it was to be based on each fuel's energy content measured in British Thermal Units. In April, to celebrate Earth Day, Clinton announced that he would reverse the government's previous position and adopt a program to stabilize greenhouse gas emissions at the 1990 level by 2000, as the Framework Convention urged. But that was the high point of environmental concern in the first Clinton administration. The president was soon distracted by the great struggle over his budget. Congress, hostile to the idea of an energy tax from the beginning, whittled the original BTU proposal down to an increase of 4.3 cents a gallon in the gasoline tax — too little to have any significant impact on consumption. When the specific details of the president's Climate Change Action Plan appeared later in the year, they turned out to be entirely voluntary. They included the promotion of products and technologies that use energy efficiently, encouragement of industry to commercialize efficient technologies to bring down their prices through mass production, and review of regulatory rules affecting energy production and use. Many environmental advocacy organizations denounced the Action Plan as inadequate.

They turned out to be right. By 1996 greenhouse emissions in the United States were 8.3 per cent above 1990 and continuing to rise steadily.[2] But the Bush administration also turned out to have been right about the Europeans when it accused them of making promises that they could not keep. By 1996 it was clear that, of the world's major industrial powers, only three would have their emissions under the 1990 level in the year 2000 — and none of them for reasons arising from environmental policy. Russia would make it because of the tremendous drop in industrial production there since the collapse of the Soviet Union. Germany would succeed because it had been closing down the grossly inefficient plants, mostly fueled by brown coal, that it had inherited from the defunct Communist regime in the former East Germany. Britain would also succeed, because the government was cutting off its subsidies to the obsolescent coal industry. But nowhere, in any of the large economies, was there any sign of a serious and purposeful effort to reduce CO_2 emissions for environmental reasons.

As 1996 began, the British Meteorological Office and the University of East Anglia, which is a central collector of global weather data, announced that the year 1995 had been the warmest in a record of temperatures going back to 1866.

The Science of Global Warming

At that point the ICPP published its second survey of the subject, three fat volumes of which the first was a review of the science markedly more decisive in its tone than its predecessor five years earlier.[3] The statistical evidence, it concluded in a widely quoted line, "now points towards a discernible human influence on global climate." But it followed that sentence with a warning about the limitations on present knowledge: "Our ability to quantify the magnitude of this effect is currently limited by uncertainties in key factors, including the magnitude and patterns of longer-term natural variability and the time-evolving patterns of forcing by (and response to) greenhouse gases and aerosols."[4]

This report is, in effect, a textbook representing mainstream opinion among the specialists in climate change and the many sciences that it touches. It does not represent unanimous opinion. Some researchers believe that the case for human influence on the climate is still unproved. But the ICPP report is now at the center of the debate over the science of global warming, which at least in Washington goes forward largely in terms of what the report said, or did not say, or should have said. This report is not as sharply conclusive as many politicians would have liked. It strongly emphasizes the many questions not yet answered, and the uncertainties that make judgment difficult. But the appearance of this report marked the point at which it became clear that most of the scientists involved had concluded that, to one degree or another, human activity appears to be playing a part in global warming.

The concentration of CO_2 in the Earth's atmosphere, the report said, was about 280 parts per million (ppm) in 1750, before the Industrial Revolution began. By 1994 it was 358 ppm and rising about 1.5 ppm per year. If emissions continue at the 1994 rate, the concentration will be around 500 ppm, nearly double the pre-industrial level, by the end of the 21st century.

Other greenhouse gases like methane and nitrous oxide have also been rising. The effect is that the atmosphere retains more of the sun's heat, warming the Earth's surface. Not all man-made additions to the atmosphere increase warming. Aerosols, tiny particles of solid or liquid suspended in the air, tend to reflect heat and diminish warming. But aerosols are mostly short-lived while the CO_2 thrown into the atmosphere will stay there for decades.

While the pattern of future warming is very much open to debate, it is indisputable that the surface of the Earth has warmed, on average, 0.3 to 0.6 degrees Celsius since the late 19th century when reliable temperature measurements began. Recent decades appear to be the warmest since at least 1400, according to the fragmentary evidence available. (Too little is known about the world's climate before 1400 to allow generalizations.)

A month after the Kyoto conference, American scientists at the National Climatic Data Center reported that the worldwide average surface temperature in 1997 was the highest ever recorded, and the 1990s the warmest decade, since reliable readings began in the 19th century. The continuing trend, they said, tended to strengthen the evidence that greenhouse gases are a cause.

The warming has not been uniform across the Earth's surface. It has been greatest in the mid-latitudes in winter and spring. Night temperatures have increased more than daytime highs. Patterns of precipitation have also changed, with greater rain and snow fall in the high latitudes of the Northern Hemisphere, and less in the subtropics from Africa to Indonesia. Global sea level has risen 10 to 25 centimeters over the past century.

The IPCC panel estimates that, on a worldwide average, temperatures will rise by 1 to 3.5 degrees Celsius by the year 2100, and sea level will rise another 15 to 95 centimeters.

Warmer temperatures could mean more droughts and floods. But the IPCC report states that present data are inadequate to judge whether climate is becoming more unstable, or that storms are becoming bigger and more destructive.[5]

To try to identify the human contribution to warming, scientists construct mathematical models of global climate. The IPCC report's conclusion is based on a finding that those models that take account of human activities run closer to the observed data than models based solely on natural factors. The early models predicted warming rates that were clearly too high, but in the 1990s the model-makers began to include the aerosols and their cooling effects, bringing their results into closer conformity with actuality. The fit is still far from perfect, and large uncertainties remain.

As the scientists put it, their models seek to identify the "signal" of human causation from the background noise of purely natural fluctuation in a climate that, over geological time, has changed continually and drastically. The test is statistical. Proof is never certain. Attribution can only be stated to a given confidence level. Different scientists have different views about the confidence level necessary to support conclusions about greenhouse warming — whether it should be 95 per cent, or 99 per cent, or 99.5 per cent. Here one's judgment is necessarily subjective. The IPCC report itself takes up the question as to when science will identify a positive anthropogenic effect (that is, an effect caused by human activity) on climate. It gives this answer: "Detection of a human-induced change in the Earth's climate will be an evolutionary and not a revolutionary process. It is the gradual accumulation of evidence that will implicate anthropogenic emissions as the cause of some part of observed climate change, not the results from a single study."[6] A few paragraphs later, the report comes to its conclusion that the "body of statistical evidence" points toward human influence. As many people have pointed out, the IPCC report neither claims absolute proof, nor does it deny that other, purely natural, forces may also be at work in the warming trend.

Within the span of recorded history, the report observes, there is no time when the climate has been changing as rapidly as it now appears to be doing. That means that historical experience is not a reliable guide. That's why it's necessary to rely on the models, although they still show systemic errors.[7] There are also uncertainties about natural variation, since accurate records go back less than 150 years.

The IPCC report clearly warns that the current models are unlikely to include all of the feedback mechanisms in the planet's highly complex climate system. This point is highly important, and cuts both ways in the political debate. It means that there may be triggers hidden in the system, visible only in retrospect, that could change the warming trend line suddenly and sharply. To people who want quick and vigorous action to limit greenhouse emissions, it seems intolerably dangerous to run the risk of a feedback that might start the warming process compounding itself rapidly. But the possibility of feedbacks working in the other direction, to stabilize the climate, are the basis for the most substantial criticism of the IPCC panel's work. Some highly qualified scientists point out that the most important of all the greenhouse gases is water vapor, and the physics of clouds is currently not sufficiently well understood to permit precise descriptions of the circulation of greenhouse gases or the way any feedbacks might operate.[8]

An issue of a different kind has arisen over the data from satellites measuring the temperatures of the atmosphere at various altitudes. These readings have been taken by some commentators to indicate that, contrary to the surface-level readings, the atmosphere has actually been cooling in recent years. But the scientists carrying out this work have argued that, when the satellite readings are corrected for the cooling effects of volcanic eruptions and for shifts in tropical ocean currents, they show a warming trend.[9]

In its general outline and tone, the IPCC report gives great prominence to the uncertainties and gaps in the present scientific understanding of the climate. As it notes, politicians will have to make decisions on climate policy without waiting for conclusive scientific evidence on the key questions.

If the physical science of this subject is uncertain, the economics is even more so. The third volume of the IPCC's report is devoted to the economic and social consequences of warming. The right approach to policy, the report proposed, is to ask what actions to take over the next decade or two to position the world to act on new findings as they appear. "Climate change demands a decision process that is sequential and can incorporate new information."[10]

If the uncertainties are prominent in the physical science, they are even greater in the economic analysis of global warming. The purpose of analysis is, or ought to be, to weigh the costs of mitigating the warming process against the costs of doing nothing.

In the present state of knowledge it is impossible to quantify the costs of doing nothing. A large factor is the risk, which is unknown, of catastrophic consequences of warming. Another factor, which usually goes unmentioned in the current debates, is the possibility of off-setting benefits of warming. One example is the prospect of longer growing seasons in northern countries like Canada and Russia.

A good deal of work has been done on the costs of mitigation, but it has resulted in a range of estimates too wide to be of much use in making policy. Many models have been constructed, but their results reflect the assumptions on which they rest.[11] The models generally fall into two categories. Some are built, in effect, from the bottom up, based on the prospect of new technologies and the benefits in conservation and emissions that they could theoretically bring. Others are built from the top down, using conventional macroeconomic experience to estimate the costs of writing off and replacing a generation of producers' equipment. It is not astonishing to learn that the first method generally produces low — often implausibly low — estimates of the costs of mitigation, while the second produces high — often implausibly high — estimates.

One of the strongest reasons for getting started on at least a small scale with some mandatory mitigation programs is to begin to accumulate reliable data based on actual experience.

Recent Negotiations

In early 1995, the UN had held in Berlin a conference of the parties to the Rio de Janiero meeting — in the jargon of the negotiators, COP-I. The idea was to assess progress on the grand promises made there. The 120 governments represented at COP-I agreed to a plan, known as the Berlin Mandate, to pursue over the next two years an attempt to set specific and binding targets and timetables to reduce greenhouse gas emissions. These targets and timetables were to apply to the industrial countries, but not the developing countries. Although that provision seemed innocuous at the time, it became increasingly controversial as time passed.

The negotiators met again for COP-II in Geneva in the summer of 1966. At that session Wirth, the former senator, now under secretary of state for global affairs and the chief American spokesman in this process, announced that the United States would support legally binding limits on emissions if other countries also did so. That was a clear and important reversal of longstanding American policy.

But there was still friction between the Americans and the Europeans. In December 1996, at an interim meeting, Wirth emphasized that the United States favored great flexibility in setting targets. Here he was following the advice of economists, who argue that flexibility means greater efficiency and lower costs in reaching targets. But in the international talks as in American domestic environmental politics, there is sharp debate between economists seeking efficiency and regulators who suspect that flexibility is merely a synonym for loopholes.

While the international talks trundled along through many meetings, there was little sign that the subject of climate change was getting much attention at the White House. The President gave it part of one sentence in his 1997 State of the Union Message: "We must also protect our global environment, working to ban the worst toxic chemicals and to reduce green house gases that challenge our health even as they change our climate." That constituted a tip of the hat, but nothing substantial.

The Europeans meanwhile were trying to turn up the pressure for action. On March 3, 1997, the 15-nation European Union called for a reduction of emissions by all industrial countries of 15 per cent below the 1990 level by the year 2010. In Britain, where an election campaign was under way, the

Labour Party pledged in its manifesto to put Britain at the front of the world environmental movement by supporting a 20 per cent reduction in CO_2 by 2010. Labour's huge win in May gave further momentum to its demand.

While the United States was committed in principle to binding limits, the Clinton administration was having trouble deciding exactly how much to reduce and over what period of time. Those questions were being hotly debated in endless meetings in Washington. The debate was being forced not only by criticism from abroad but by a deadline. A third meeting of the conference of parties, COP-III, was scheduled to be held in Kyoto in December 1997 and the negotiators hoped to write a treaty there that would set the promised legal limits.

In June, at the annual meeting of the world's leading industrial powers, the Europeans began to press Clinton personally and publicly. Clinton agreed that global warming is a serious issue, but avoided specific numbers for the emissions ceilings. The president of France, Jacques Chirac, chided the Americans as "great polluters" and said that they generate three times as much CO_2 per capita as the French do.

Immediately after the Denver meeting the UN's General Assembly convened a special session in New York to assess the progress on the Rio pledges. The progress, it found, was minimal. The Europeans continued to assail the United States for failing to join them in supporting a sharp rollback in emissions. Britain's new prime minister, Tony Blair, offered the comment that "the biggest responsibility falls on those countries with the biggest emissions." The United States's emissions are the largest of any country, by a wide margin.

The reasons for the tension between the Americans and the Europeans are rooted in deep differences between the economies and politics of the two continents. Only a few of the European countries have substantial energy industries under private ownership. Both the United States and Canada have hugely important energy industries with great political influence, not only through corporations but through the labor unions. By 1997 a number of American unions, led by the United Mine Workers, were fiercely hostile to any treaty on global warming. Europeans have a stronger conservation tradition, and already have energy prices much higher than those in the United States. Some of them would also point out that they live much closer to the horrific pollution that the former Communist governments of Eastern Europe created in their desperate efforts to wring faster growth out of their badly run industries. In some European countries there are vigorous Green parties nipping at the heels of their governments.

In addition to the disputes between Americans and Europeans, the UN session also displayed a broader range of differences between North and South — the rich countries and the poor. At Rio the rich had promised new aid, amounting to about $6 billion, to the poor to help them toward more efficient use of energy. Very little of that money had actually been forthcoming. Some of the oil-exporting countries were trying to claim compensation for any world-wide attempt to drive down energy consumption, and with it their incomes. A group of small countries inhabiting low-lying islands plaintively observed that continued rises in sea level threatened to sweep them and their people off the map altogether. More important, many people in the big countries well embarked on industrialization, especially China and India, suspected that the whole idea of global warming was a device invented by the rich countries to hold down growth among their newest competitors. In general the Third World regarded the threat of global warming, if it actually existed, to be a creation of the rich countries and felt that it was up to the rich countries to deal with it.

In this atmosphere President Clinton went to New York in June to address the UN's special session. "The science is clear and compelling," he said. "We humans are changing the global climate." He spoke of new technologies and economic strategies like emissions trading that would, he argued, allow reductions in greenhouse gases without damaging economic growth.

For the first time the president personally declared himself in favor of limits: "We will work with our people, and we will bring to the Kyoto conference a strong American commitment to realistic and binding limits that will significantly reduce our emissions of greenhouse gases." But, as all his critics immediately observed, he again declined to say where the United States wanted to put those limits. The American position remained undefined.

Clinton clearly felt that, before he proceeded to any serious action, he would have to get more Americans focused on the subject. On July 24 he held a White House conference in which he and Vice President Gore, the administration's ranking environmentalist, opened a campaign for greater public awareness. "We see the train coming," the president said, "but most Americans in their daily lives can't hear the whistle blowing."

On the following day, as though in response, the Senate passed, 95 to 0, a resolution telling the president not to sign at Kyoto any treaty putting limits on the developed countries' emissions unless it also committed the rest of the world to take action. While lobbyists for some of the energy companies had been pushing this idea, it spoke to much wider concerns in Congress. Specifically, the Senate feared that the treaty might hamper American industrial expansion to the benefit of China, with which this country is already running a very large trade deficit, and other newly industrializing economies.

Pursuing his effort at public education, the President held another White House conference on Oct. 6. Vice President Gore was again there, along with much of the Cabinet. Clinton set out four principles to guide policy. Three repeated past statements. "First, I'm convinced the science is real." Second, the United States must be prepared to commit itself to "realistic and binding" goals. Third, those goals must permit the economy to keep expanding.

And fourth, he continued, all the world's nations must participate. At Kyoto, the president said, the United States wanted "meaningful, but equitable" contributions from all countries. That was new, and meant that he had decided against fighting with the Senate over China's role. But it raised severe difficulties for the negotiators working toward a treaty text for Kyoto. Most of the developing countries were adamantly against any restrictions on their emissions until they had seen a serious and substantial effort by the rich economies. In addition, the Europeans complained that Clinton was changing the terms that had been agreed in the Berlin Mandate two years earlier. This new requirement was introduced by the United States in the final weeks of a cumbersome negotiating process, involving more than 140 governments, that had been going on for two and a half years.

Japan's government, as host of the Kyoto conference, was deeply anxious that it not become a fiasco. On the same day as Clinton's White House conference, the Japanese brought out their own proposal for emissions goals: reduction to 5 per cent below 1990 levels by 2012. The proposal, intended as a compromise, also included complex formulas for differentiation — that is, for varying the goal in response to each country's particular circumstances.

The lower Japanese targets drew jeers from some environmentalists and reproaches from the Europeans. But then some Americans began pointing out that the European Union's plan, when read closely, was revealed to provide wide differentiation among the EU 's member countries while firmly opposing any differentiation at all outside the EU. Critics also observed that the Europeans had had very little to say about the policies by which they might actually achieve the targets that they were proposing. By this time even those politicians around the world who hadn't been following global climate policy very carefully were becoming aware of the political and economic implications of a possible Kyoto treaty.

But up to this point the debate had a loose and slightly unrealistic quality, because the country with the greatest influence had not yet disclosed its position. That changed on Oct. 22, when the president went to the National Geographic Society in Washington, the proper setting, he thought, for an address on global climate change.

President Clinton's Oct. 22 Program

In the key lines of his speech, the president said that the United States would commit itself at Kyoto to "the binding and realistic target of returning to emissions of 1990 levels between 2008 and 2012. And we should not stop there. We should commit to reduce emissions below 1990 levels in the five-year period thereafter, and we must work toward further reductions in the years ahead." That schedule was slower than the one proposed by the EU although, the administration argued, stronger than the Japanese position because it included a longer list of greenhouse gases.

Clinton repeated his position on the developing countries, to leave no doubt regarding the American position at Kyoto: "...both industrialized and developing countries must participate in meeting the challenge of climate change. The industrialized countries must lead, but developing countries also must be engaged. The United States will not assume binding obligations unless key developing nations meaningfully participate in this effort."

The American proposal was drafted to address the long term. As the administration conceived it, this program was to fall into four five-year phases. In the first, from now until 2002, the inducements would be all carrots and no sticks. The federal government would provide $5 billion in incentives, including tax preferences, to encourage the development and installation of new technologies to produce and use energy more efficiently. To industrial plants that reduce their greenhouse gases now, the government would offer special credits to be cashed in when the mandatory restraints on emissions took hold later. As Gene Sperling, the president's assistant for economic policy, put it in a press briefing, this first phase will be devoted to "the things America can do without waiting, without, we think, conflict." The concept was to exploit first the technologies that already exist.

The second phase would be devoted to evaluation what has been accomplished and taking account of new developments in science. Nothing envisioned in these first two stages, other than minor tax cuts and other incentives, was to require congressional action. The method would be, again, carrots alone.

The binding and mandatory limits were to be applied in the third phase, from 2008 through 2012, with the intention of getting the country's greenhouse gas emissions back down to the volumes of 1990. As noted earlier American emissions in 1996 were already 8.3 per cent above 1990. By the administration's calculation, by 2010 they would be 34 per cent above 1990 if they continued on the present track.[12] As the president described it, voluntary reductions might well bring emissions close to the necessary 1990 target even before the mandatory limits go into effect. The enforcement system, he suggested, might follow the model of the present market for sulfur dioxide rights to control acid rain. That mechanism applies only to large industrial power plants, most of them run by electric utilities.

The suggestion here was that the future emissions reduction regime would operate mainly, if not exclusively, through the large industrial sources. Through two decades of experience, environmental policy makers have discovered that the American public has a fairly high tolerance for costs of protection as long as they are filtered gradually through utility bills. But it has very little tolerance for directly imposed costs, as in higher costs for gasoline. There was nothing in the president's program that remotely hinted at restraints on individual citizens' activities, such as driving.

Nor was there any reference to nuclear power or hydropower, at present the only technologies that generate electricity on a large scale without producing carbon dioxide. Any indication of an expansion of either would incense much of the environmental movement, illustrating one of the many hazards in climate politics.

In the fourth phase of this program, the years after 2012, president said, the country would push its emissions down below the 1990 level to a target not yet specified.

Another notable omission in the president's plan was any discussion of preparations for life in a somewhat warmer world. If the president is correct in believing that CO_2 emissions are raising temperatures, some measure of warming is going to be inevitable in the 21st century. No one in political office, in this country or any other, is talking about the kind of draconian reductions in current emissions that would be required to hold the concentrations of CO_2 in the atmosphere at their current levels. The question is not whether the world will get warmer, but only how fast it will happen. Adaptation to a changing climate will be unavoidable. But it is a subject that carries a heavy ideological freight, for many people in the environmental movement suspect that any discussion of adaptation can only distract attention from the efforts to cut emissions.

The president's purpose in his Oct. 22 address was less to lay out a detailed program than to get Americans thinking about climate change and to take the prospect seriously. Before anything else could be done, he had evidently concluded, he needed to build a political base for action. Throughout his address the president sought to elevate the issue of global warming without getting entangled in the difficult and controversial choices that a serious policy would, sooner or later, require. The time for vigorous administrative and regulatory blueprints would come only when, to use his metaphor, Americans began to hear the train's whistle. In his October program, he chiefly wanted to get Americans into the habit of making a connection between changes in the weather and their own use and misuse of fossil fuel. Beyond that, he wanted the engineers and boards of directors running utilities to begin routinely taking into account the idea that at some point the equipment they install today may have to meet new and much tighter emissions standards.

But there is another side to this subject. However persuasive the administration's political calculations were, certain economic realities also applied. In particular, the administration was caught in two dilemmas.

The first involved prices. Far from talking about increased energy prices, the administration was saying that under its plans they would stay low or perhaps even fall. Lower prices generally mean higher consumption and higher CO_2 emissions. The administration did not deal with this contradiction but merely deferred it, with much else, to the future. That led to the second dilemma.

The president's program depended heavily on the credibility of its promise that, a decade from now, mandatory reduction in emissions will be enforced by federal law. If people do not believe that — especially the people making decisions on the design of long-lived industrial equipment and consumer goods — they are unlikely to begin making the substantial investments that a low-emissions regime requires. The administration's offer of $5 billion in subsidies and tax breaks does not begin to cover the enormous costs of shifting to that regime. To have any significant effect without greater outlays of federal money, it would be necessary that both industry and, ultimately, consumers consider it highly probable that a time will come when cooperation is no longer voluntary. The sketchiness of the Clinton program, its evasiveness on pricing and its very long timetable all militated against its credibility.

The Kyoto Conference

Less than six weeks after President Clinton had announced his program, the international conference to draft a treaty opened at Kyoto, Japan. It was a huge affair, with some 10,000 officials from nearly every national government on Earth plus a large following of lobbyists and observers from a great variety of non-governmental organizations representing environmental interests and industries. Originally scheduled to run from Dec. 1 to 10, it got off to a slow start and, like many hard-fought negotiations, picked up speed only in the final hours when the meetings had run into overtime.

On Dec. 8 Vice President Al Gore flew in from Washington for a one-day stop, pushing the process forward with the message that the United States was willing to compromise by agreeing to a deeper emissions cut than the President had specified in October. Even then the talks bogged down again over the vehement resistance of some developing countries to the concept of emissions trading. The chair of the conference's committee of the whole, Raul Estrada Oyuela of Argentina, warned that the whole proceeding would collapse in the absence of more flexibility. Eventually, in an all-night session, he managed to broker a deal notable for the key issues left to the future. The committee of the whole completed the text of the Kyoto Protocol at 10.15 am on Dec. 11, and the plenary session convened that afternoon to adopt it.[13]

The proposed Protocol settles a number of difficult issues. The most visible, the targets and timetable for emissions reduction, split the difference between the United States and the European Union. Where the U.S. had wanted a target of returning to 1990 emissions levels and the EU had wanted one 15 per cent below it, they agreed on a target for the U.S. 7 per cent below the 1990 level and, for the EU, 8 per cent below it. But within the EU the text allows wide country-by-country variations. Japan will cut emissions to 6 per cent below 1990. Several smaller economies will be allowed to increase emissions: Iceland 10 per cent above 1990, Australia 8 per cent above and Norway 1 per cent above. Several will be required only to return to 1990 levels: Russia, Ukraine, New Zealand. The others will reduce emissions by varying amounts in the range from 95 to 92 per cent below 1990. These limits have been accepted by 38 countries — those conventionally called developed, including Eastern Europe and some of the former Soviet Union. In the language of the Protocol, these are the Annex I countries. These cuts are calculated to amount to a reduction in worldwide emissions of 5.2 per cent below 1990.

The conference accepted the American idea of a five-year target period, 2008 through 2012, rather than a single date.

It also accepted the American proposal to include all six of the major greenhouse gases. There had been some sentiment in favor of covering, at this stage, only the three most important: CO_2, methane and nitrous oxide. But, as completed, the text also covers hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Emissions are to be measured and counted by methodologies established by the IPCC in its role as scientific advisor to the process.

On a less conspicuous but equally important point, the governments were finally able to agree to count net, not gross, emissions. A forest is a sink for CO_2; that is, it absorbs the gas out of the atmosphere. Most of the developed countries strongly favored allowing for sinks, on grounds that it would encourage planting trees and discourage burning them. Some developing countries, notably Brazil, were uneasy about this language, apparently fearing that it would turn into a condemnation of their land-clearing practices. They asked whether it would create a license for rising emissions in the developed countries. But the developed countries won that one, and the final text (Article 3, paragraph 3) permits them to count net changes in sinks "resulting from direct human-induced land use change and forestry activities" since 1990.

The protocol is to be open for signature from March 16, 1998, to March 15, 1999. It is to come into effect 90 days after the fifty-fifth government ratifies it, assuming that those 55 countries account for at least 55 per cent of the CO_2 emissions of the developed countries in 1990. That percentage was chosen to ensure that most of the developed countries' emissions would be covered, but not so high a proportion that any one country —meaning the United States — could veto the protocol by refusing to approve it. This provision is not, of course, likely to have much practical effect since few of the major economies are likely to ratify this agreement unless the United States does.

Before the United States can ratify the protocol, it must go to the Senate. That leads to another large subject.

The Issues Left Unresolved at Kyoto

The Kyoto conference was a success, in the sense that it came to agreement on a document that covers an extremely difficult subject touching many interests. It represents substantial progress toward a worldwide agreement on greenhouse gases and, by implication, the production and use of energy. But the negotiators arrived at that achievement only by explicitly postponing to later meetings some questions that the United States considers crucial. They also used notably vague language to patch over several troublesome disputes. There are five major points on which the administration is going to need further progress or clarification before it can safely send the Kyoto protocol to the Senate.[14]

First and most obvious, the United States got nowhere at Kyoto with its demand that the largest of the developing countries commit themselves to some kind of limitation on emissions. In Congress there is a broad consensus, including both parties, against any agreement that does not somehow include China, Mexico, and South Korea. There is a widespread concern that emissions restrictions in this country will simply provide an economic incentive to companies to shift industrial production, and the jobs it represents, to sites abroad where no such expensive rules apply. Vice President Gore, speaking for the administration, has said flatly that the treaty will not be submitted to the Senate until the leading developing countries are included. Since the next negotiating session has been scheduled for November 1998, the treaty is unlikely to move toward ratification until 1999 at best.

Second, the United States has insisted on international trading in emissions rights and on joint implementation. Trading means that a country that is under its limit can sell emissions rights to a country, or to a corporation in a country, that is over its limit. Joint implementation means that a company in, say, the United States, wishing to expand and increase its emissions, can earn the right to do it by making investments that reduce emissions elsewhere in the world. But, to make these markets work, the countries on both sides of the deal have to be under emissions limitations. Otherwise there is no baseline against which to score the increases and decreases. The greatest opportunities to reduce emissions cheaply are in the Third World. That adds to the American interest in bringing developing countries into the system.

In demanding a mechanism to trade emission rights, the United States cites its own experience as proof that trading will maximize the efficiency of emissions reduction. The American legislation to curb acid rain established a market in SO_2 emissions rights, and the result has been to bring down those emissions at a cost far below the electric utilities' expectations. Applying this lesson to global warming gases is good economics.

But it has run into substantial political opposition. Some Third World governments fear that the developed countries will use their great financial power to buy their way out of emissions restrictions and transfer those limits to poorer countries, where they will interfere with industrial development. Some Third World officials have spoken of joint implementation as environmental colonialism. At Kyoto India, with the support of China and Indonesia, declared its opposition to the concept of trading on grounds that it is irrelevant to the Berlin Mandate — which in those countries' view leaves them out of the system at this stage — and that it would not lead to reductions. When developing countries' opposition to trading threatened to stalemate the whole Kyoto conference in its last hours, the British came up with a compromise paragraph (Article 16 bis) that accepts the concept of trading in principle, but leaves the design of the market and its rules entirely to a future conference.[15] Again, the Clinton administration is not likely to send the protocol to the Senate for ratification until a matter of such central importance to the United States has been more clearly resolved.

Until now, these negotiations have moved forward by consensus. But the Kyoto Protocol foresees the possibility that it may not be possible to resolve some disputes by consensus and it sets a rule of one vote for each country, as in the UN's General Assembly. Since the developed countries are outnumbered three to one by the undeveloped, the administration cannot be confident that it will prevail in these future conferences.

It is quite possible that trading and joint implementation will also be attacked in the U.S. Congress, although for reasons very different from India's. It has not escaped congressional notice that these arrangements would result in a substantial flow of investment capital from the United States to other countries. Rep. Bill Archer (R-Texas), the chairman of the House Ways and Means Committee, recently said, "It's another form of foreign aid."[16]

Third, the Protocol also provides for explicit financial aid, in the form of funds given by rich countries to poor ones to help them set up emissions accounting procedures and to promote the transfer of technology. But it is very vague about the amounts, speaking only of "new and additional financial resources" (Article 11, section 2 (a)).

There's a long and contentious history to this phrase. It's drawn directly from the Framework Convention on Climate Change, the treaty signed in 1992 at Rio, which declared that the money would be handled by a new agency run by the Conference of Parties to the treaty — that is, all the governments that had joined it. As an interim measure, only until the new agency could be organized, it would be run by the Global Environmental Facility that had been created by the World Bank. But, five years later, as the governments met again at Kyoto, the new agency had not yet appeared and the Global Environmental Facility was still in charge. Many developing countries considered that a betrayal. One political issue here concerns control and voting procedures. The Third World countries have a majority in the Conference of Parties, but the GEF is run under complex voting rules that, as in the World Bank itself, gives reliable control to the donor countries. Another source of resentment among the developing countries is the amount of money provided, which has turned out to be much less than many of them expected.

The Kyoto Protocol would establish a Clean Development Mechanism to regulate joint implementation (Article 12). It would operate under the Conference of Parties and would assess a share of the proceeds from joint implementation projects to help developing countries "that are particularly vulnerable to the adverse effects of climate change." That would be, in effect, a transaction tax on these projects with the tax rate to be set by the Conference of Parties.

These financial issues have received a great deal of attention among Third World governments. Their disappointment with the rich countries' performance under the Rio Treaty, and the promises it made, has contributed heavily to the suspicion and resentment with which many of these governments reacted to the American proposals at Kyoto. While the financial aid provisions have hardly been mentioned so far in the United States, many developing countries consider them crucial to any further cooperation on their part.

Fourth, the whole question of sanctions and what to do about countries that fail to meet their commitments was deferred to a future meeting of the Conference of Parties (Article 17). The question was, in effect, too hard to resolve at Kyoto. But it is difficult to believe that many of the developed countries will be willing to ratify the Protocol without some assurance of significant penalties against those that violate it.

There was some discussion of sanctions during the negotiations, but they came to no resolution. None of the current proposals is very attractive. One possibility might be monetary fines, but that would be received with suspicion by Third World officials who fear that some rich countries might simply choose to pay and pollute. Another idea is a rule that a country exceeding its limit in one period would be required to make up that excess in the next period. But that would not bring any additional pressure to bear on a country that simply continued to disregard its commitments. A third proposal is to enforce the limits with trade sanctions. The trouble with trade sanctions is that they are dangerously powerful. They threaten economic growth, not only in the country being sanctioned, and they generated political tensions that can quickly turn ugly.

Diplomats point out that the history of international agreements shows that most countries make a good-faith effort to live up to them most of the time. But that assurance is probably not going to be accepted by the opponents of the Kyoto Protocol, who observe that in this case violators would gain a substantial commercial advantage over their competitors.

Fifth, no government has yet offered any clear outline of the actual policies and methods by which it would meet its commitments under this Protocol. In this respect, the Clinton administration is typical. The President's last word on the subject was his Oct. 22 program calling for little more than voluntary efforts until 2008. But the country is now committed to an emissions reduction of 30 per cent from the level that, by the administration's calculations, it would reach by 2010 under present policy. In a period of only 12 years, a 30 per cent reduction is a massive change with deep implications for industrial practices and consumers' habits alike. If the administration has no intention of using taxes and higher energy prices to push that change, it is difficult to see how it can begin to meet this very ambitious target.

In the United States and every other democracy, emissions reductions on this scale will require public debate, and public engagement with the issues of energy use, of an intensity not yet visible. Some governments have begun to talk about action to meet the Kyoto requirements. Britain, on beginning its six-month term as president of the European Union in January, said that one of its priorities would be to get moving on a climate change policy. But the governments at Kyoto set their goals with no clear strategy for getting there, or clear estimates of the costs of doing it.

In Article 2, the Protocol says that the developed countries shall undertake various policies and methods “such as” improving energy efficiency, promotion of sustainable agriculture, research and development addressed to new and renewable energy sources, ending energy subsidies and so forth. This phrasing was a compromise between countries that wanted the Protocol to specify mandatory measures and those that did not.[17] The elasticity of the language leaves it up to governments to interpret the article as they choose.

A Final Comment

The Kyoto conference was the beginning, not the culmination, of the first serious international attempt to address greenhouse emissions and the prospect of climate change. Kyoto was not the last word but rather only a stage in working toward genuinely binding international agreements. That has disappointed those people who had hoped for dramatic action. But it was consistent with the advice that scientists are still far from a reliable grasp of the planet’s climatology, just as its diplomats and politicians are far from a consensus on dealing with it.

The climate is not the only factor that will affect the quality of life on this Earth in the 21st century. The population of the world is also rising rapidly. While its rate of growth has slowed over the last several decades, it is still rising several times as fast as the CO_2 concentrations in the atmosphere. The world’s economic output in recent years has been rising half again as fast as its population and there are few people — certainly not President Clinton —who are prepared to slow down productivity in order to protect the climate. Global warming, population increase and economic expansion are all related to each other.

“It is our solemn obligation to move forward with courage and foresight to pass our home on to our children and future generations.” Clinton said at the National Geographic Society in October. But because of all that a restless and creative humanity does from day to day, our children and future generations are going to live in a world very different from the present one. A changing climate will be only one of those differences.

###

Endnotes

[1] A useful summary of this history is provided by Matthew Paterson, *Global Warming and Global Politics,* London and New York, 1996. See Chapters 2 and 3.

[2] U.S. Department of Energy, *Emissions of Greenhouse Gases in the United States 1996,* Washington, DC, Oct. 22, 1997.

[3] While the reports were actually published in book form in 1996, their conclusions had become widely known in late 1995 as various meetings approved the texts. The section on science became public Nov. 30, 1995, at a meeting in Madrid.

[4] Houghton, J. T., and others, eds., *Climate Change 1995: the Science of Climate Change,* Cambridge, 1996, p. 439.

[5] This summary of the report's summary comes from op. cit., pp. 1-7, 28.

[6] Op. cit., p. 438.

[7] Op. cit., p. 413, 416.

[8] See, for example, the testimony of Ronald G. Prinn, director of the MIT Center for Global Change Science, before the subcommittee on energy and environment of the Committee on Science, U.S. House of Representatives, Oct. 7, 1997. Prinn told the.committee that forecasts of slow or rapid growth are equally defensible, in the present state of knowledge, and in his view it would be as irresponsible to overreact as to do nothing.

[9] See, for example, the testimony of John R. Christy, University of Alabama, Huntsville, before the Committee on Environment and Public Works, U. S. Senate, July 10, 1997.

[10] Bruce, James P., and others, eds., *Climate Change 1995: Economic and Social Dimensions of Climate Change,* Cambridge, 1996, p. 26.

[11] Repetto, Robert, and Duncan Austin, *The Costs of Climate Protection: a Guide for the Perplexed,* World Resources Institute, Washington, 1997.

[12] U.S. Department of Energy, Energy Information Administration, press release, Nov. 12, 1997.

[13] Warrick, Joby, *The Washington Post,* p. A-1, Dec. 13, 1997. See also the detailed and very useful account of the proceedings published by the semi-official *Earth Negotiations Bulletin,* Vol. 12, No. 76, available on the Internet at www.iisd.ca/linkages/vol12/enbl276e.html#1.

[14] On this subject I am indebted to two articles in *Weathervane* by Raymond J. Kopp, Richard D. Morgenstern and Michael A. Toman, "The Kyoto Protocol: Unresolved Issues," at http://www.weathervane.rff.org/features/feature026.html, and "The Realities of Implementation," http://www.weathervane.rff.org/features/featureo27.html.

[15] See the Earth Negotiations Bulletin summary cited above.

[16] *Congressional Quarterly,* Nov. 29, 1997, p. 2953.

[17] *Earth Negotiating Bulletin,* cited above.

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A DIGITAL FORUM ON GLOBAL CLIMATE POLICY

As policymakers prepare for the upcoming meeting of the Conference of the Parties, Resources for the Future (RFF) recently launched *Weathervane*, an internet forum dedicated to climate change policy. Published at **http://www.weathervane.rff.org**, *Weathervane* is designed to provide the news media, legislators, opinion leaders, and the interested public with analysis and commentary on U.S. and international policy initiatives designed to reduce emissions of greenhouse gases.

Just as a traditional weathervane tracks the direction of the wind, *Weathervane* tracks the developments in climate change policy, both internationally and within the United States. And, just as one of the basic rules for designing a weather vane is that there must be equal mass on either side of its center, its editorial aim is to present balanced and objective information, with no one perspective or viewpoint dominating our analysis and reporting. With the stakes potentially enormous on all sides of this complicated issue, *Weathervane* strives to provide a neutral forum for careful analysis to complement the political calculations that so often drive decisions.

Weathervane includes feature articles and news commentary written by the online publication's staff, RFF researchers, and invited policymakers and opinion leaders. The site also contains a number of departments. These include:

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A regular column by RFF's Ray Kopp to help decode and demystify energy and environmental data and create a better understanding of the link between economic data and policy formulation.

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Other features include: **Research Spotlight**, which sheds light on new climate findings and projects; **Sounding Off**, an open forum for site visitors to voice their opinions on a variety of topics related to climate change; and, an expanding glossary of economic, environmental and ecological terms often used in climate change negotiations.

Since its launch in mid-July, *Weathervane* has, as of November 1, hosted more than 12,250 site visitors who have logged nearly 212,000 hits to individual pages. In addition to the U.S., site visitors have logged in from Canada, Australia and New Zealand, Japan, France, Denmark, Norway, the Netherlands, the UK, Austria, South Korea, Taiwan, Italy, Malaysia, and Brazil, among other countries.

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FEATURE

Estimating the Costs of Kyoto: How Plausible Are the Clinton Administration's Figures?

By Raymond J. Kopp and J.W. Anderson

MARCH 12, 1998 -- In its defense of the Kyoto treaty to control global warming, the Clinton Administration argues that the economic costs of compliance would be modest. Since the Administration has disclosed much of the methodology it is using, it is possible to arrive at a judgment on the plausibility of these cost estimates.

They are reasonable, if one accepts all of the assumptions that the administration is making. But those assumptions require careful inspection.

Janet Yellen, chair of President Clinton's Council of Economic Advisers, gave the Administration's cost estimates on March 4, 1998, in testimony before the House Commerce Committee. Compliance with Kyoto, she said, would mean an emissions price in the range of $14 to $23 per ton of carbon equivalent. In other words, the cost per ton of the GHG gas reductions discussed in the testimony would amount to $14-$23.

"This increase in energy prices at the household level would raise the average household's energy bill in 10 years by between $70 and $110 per year," she said. Overall, for household consumers, it would mean an increase of 3 to 5 percent in energy costs in the years 2008-2012 or, for example, an increase of 4 to 6 cents a gallon of gasoline.

Analysis indicates that these figures are not impossibly low. But it is essential to recognize that they are based on an assumption that the United States will not drastically reduce energy consumption, or decrease its own greenhouse gas emissions by anything approaching the 30 percent from the present trend that the Kyoto treaty would seem, at first glance, to require.

Rather, it assumes that the United States will reduce its annual emissions in the period 2008-2012 by a modest 3 percent from the emissions in the period 2008-2012 by a modest 3 percent from the trend line and make up most of the rest of its commitment by paying other countries to reduce their emissions through a system of tradable emissions credits.

What Models Were Used?

Dr. Yellen did not provide in her testimony any detailed economic calculations to support her conclusions. But she was fairly explicit in describing the key assumptions and the economic models on which they were built.

The administration has drawn on a wide range of models of the energy sector and of the economy over the next 25 years, she said. No model has yet been constructed to analyze the Kyoto treaty specifically, since it was written only in December.

"Our thinking has been informed, however, by simulations conducted with the Second Generation Model of Battelle Laboratories, one of the leading models in the field," she told the Commerce Committee. "The SGM is one of the models best positioned to analyze the role of international trade in emissions permits, which we consider to be a critical element of the Kyoto Treaty."

The Second Generation Model is one of three used in the Administration's earlier Interagency Analytic Team (IAT) study, for which model results are publicly available. Battelle researchers have also used the SGM for additional work that is also in the public domain. Using the assumptions stated in Dr. Yellen's testimony and the results available from the SGM, we can draw reasonable conclusions about the validity of the cost estimates and the greenhouse gas emissions on which they are based.

The Administration's work on the Kyoto issues has made clear, Dr. Yellen testified, the importance of flexible, market-based trading mechanisms.

"Within the Kyoto Protocol, this means an insistence on international trading, joint implementation, the clean development mechanism, and, ultimately, on meaningful developing country participation," she testified.

In the context of the Kyoto treaty, Dr. Yellen's insistence on international trading means that a company wanting to expand operations (and emissions) could buy the permits on a worldwide market at the lowest bid from another country, or a company in another country, that would reduce its emissions by the same amount. As it stands now, provisions for international trading are limited to developed economies -- the so-called Annex 1 countries. Joint implementation and the clean development mechanism refer to a system of bilateral agreements in which companies or countries could accomplish the same thing but could obtain the permits from developing countries (non-annex 1).

The Kyoto treaty permits trading only among industrialized countries. The United States' insistence on bringing the developing countries into a system of worldwide trading is highly controversial.

The Clinton Administration is assuming that it can get worldwide trading into the treaty, and that it will be highly efficient -- as efficient as the New York Stock Exchange.

The Second Generation Model results show why the Administration is putting such heavy emphasis on the necessity and efficiency of trading. When analyzing the costs of complying with an emissions reduction scenario similar, although not quite the same, as the Kyoto treaty, researchers at the Pacific Northwest National Laboratory last October used the SGM to work out the numbers for three scenarios.

In the first, the United States could not trade emissions permits with any other country, and the implicit cost of emissions reduction came to $108 per ton of carbon. If the United States and its companies could trade with their counterparts elsewhere in the industrial world, costs would fall to $72 per ton. With full worldwide trading, the costs fell further to $26 per ton. That is virtually the same as the upper bound on Dr. Yellen's estimates.

This study by the Pacific Northwest National Laboratory also sheds light on the CO2 reductions that would have to be met domestically and those that could be purchased abroad under these three scenarios. With no trading of emission reductions obligations across borders, all of the reductions would have to be made in this country -- causing the high estimated price. If there was trading with other industrial countries, the study showed, slightly less than half of the American quota of reductions would be made in this country and the rest could be purchased abroad. With worldwide trading, it added, only about 15 percent of the American obligation would be met by reductions in this country, and the rest abroad.

Dr. Yellen's testimony implied that, with no international trading, the cost of emissions reduction in this country would run to $125 per ton. With trading among the industrial countries including Russia and eastern Europe, it would drop to $30 to $50 per ton. With worldwide trading, she said, it would drop still farther to

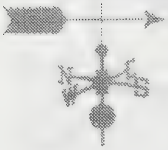
$14 to $23 per ton.

The Clinton administration has said repeatedly that it will not send the Kyoto treaty to the Senate for a ratification vote until it is changed to provide for participation by the big developing countries, and for worldwide trading in emissions permits.

But even setting aside the imprecision of all models, which Dr. Yellen acknowledged, there are several further assumptions in the Administration's calculations that deserve attention.

They assume that there are vast opportunities for cheap emissions reductions to be had, particularly in the developing world -- enough of them to satisfy European and Japanese demand as well as American.

They also assume that the trading system will work with near-perfect efficiency. It might be noted that the Kyoto conference put into the clean development mechanism a provision for a transaction tax "to assist developing country parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation." The imposition of any substantial tax on trading would change all the figures.

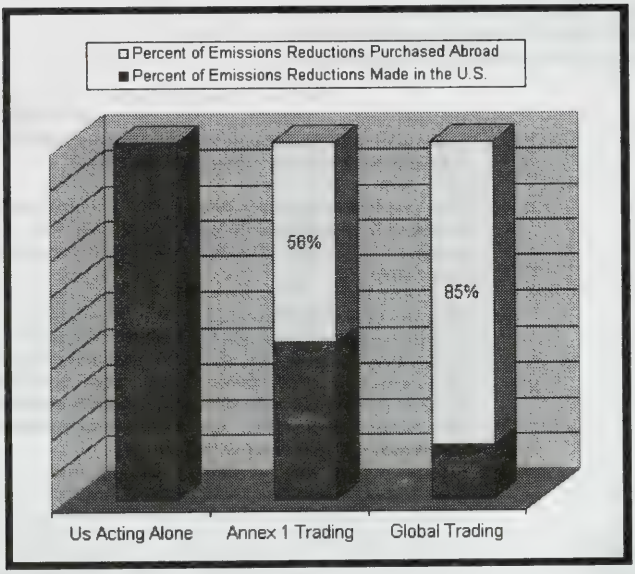


That raises a final question: Is there the political will, here and abroad, to sustain a free market in permits? One issue is whether environmental organizations will support a system that would result in the reductions falling disproportionately in the Third World. Another is whether the Third World and its leaders will permit it. The basic reason for their current opposition to trading is the widespread fear that the rich countries will use their financial power to buy their way out of emissions limits, while limits grow tighter on the poor. It is possible that developing countries with low-cost emissions reduction opportunities might band together to force up the price artificially through an OPEC-like cartel. It is also not clear that the U.S. Congress will support a system that envisions large outflows of investment capital to the poor countries for emissions permits. Some influential congressmen have already begun to refer to emissions trading as foreign aid.

Dr. Yellen's cost estimates have a respectable analytical base. But to turn them into economic reality will require satisfactory answers to a lot of outstanding questions, of which many are essentially political.

__Raymond J. Kopp__ directs RFF's Quality of the Environment Division.
__J.W. Anderson__ is RFF's Journalist-In-Residence.

An Estimate of the Proportion of Emissions Reductions that the U.S. Would Buy Abroad Under Three Scenarios



Annex I trading refers to trading restricted to the industrial, or Annex I, countries and excluding the developing countries.

Source: Adapted from "Return to 1990: The Cost of Mitigating United States Carbon Emission in the Post-2000 Period," Edmonds, et al, October, 197 Pacific Northwest National Laboratory, PNNL document number 11819.

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FEATURE

Annex B Emissions Trading and "Joint Implementation: A Primer

By Raymond Kopp and Michael Toman

"Emissions trading" is one of the key "flexibility mechanisms" built into the Kyoto Protocol negotiated among 168 governments in December 1997. Supporters of trading argue that it will greatly reduce the overall costs of complying with the reductions in greenhouse gas emissions that the Kyoto Protocol would require. But the rules for a trading system have yet to be worked out, and skeptics question its potential efficacy. The issue is likely to be one of the main subjects at the next international negotiation session on global warming, which begins Nov. 1 in Buenos Aires. In the United States, the Clinton administration has said that it will not send the Kyoto Protocol to the Senate for ratification until, among other conditions, the provisions for trading are explicit.

In addition to technical issues of administration and enforcement, international emissions trading raises substantial economic and political questions. The Clinton administration is using cost estimates implying that the United States intends to buy abroad as much as 85 per cent of the permits it would need to comply with the Kyoto reductions, instead of making those reductions in the American domestic economy. But in the section (Article 17) in which the Kyoto text authorizes trading, it adds that this trading "shall be supplemental to domestic actions." Some negotiators from other regions, particularly Europe, have questioned whether the American intentions meet the "supplementarity" test of the Kyoto language, and they have proposed limits on the use of international trading that would drive up compliance costs for the US and other countries.

Emissions trading is a mechanism for use among the "Annex B" industrialized countries, basically the OECD (minus South Korea and Mexico) plus the countries of the former Soviet Union and Eastern Europe. All of these countries have numerical emission limits in the Kyoto Protocol to be reached by 2008-2012. Another flexibility mechanism in the Kyoto Protocol, the "Clean Development Mechanism" (CDM), involves transactions between Annex B countries and developing countries that do not have national emission limits. The CDM is discussed in a companion to this paper. Developing countries also could opt into the trading system voluntarily by assuming national limits.

I. How Would a Trading System Work?

One of the most important tenets of economics has to do with the "gains from trade." Any exchange of one set of goods and services for another must benefit all parties for the trade to succeed.

To understand the gains from trading emission permits, consider a homeowner who wakes up one morning to find broken water pipes in the bathroom and water gushing all over the floor. The homeowner could stay home and fix the pipes but that would mean losing a day's pay at work. Instead, the homeowner realizes it is cheaper to pay a professional plumber to fix the pipes and for the homeowner to go to work. In this case, both the homeowner and the plumber can fix the pipes, but the plumber can do it cheaper so both parties benefit if the homeowner pays the plumber.

Trading greenhouse gas emission permits is akin to the plumbing example, in that those buying emission "permits" or "credits" actually are paying someone else to reduce emissions who can do it more cheaply than they can. Internationally, this can occur in a couple of distinct ways. One possibility is that Annex B countries could establish domestic emission trading programs to meet their Kyoto obligations. In the absence of emissions trades among countries, the prices of emission permits could differ. This would mean that the incremental cost of emission control would be higher in the countries with higher permit prices. International trade in the domestic permits of different countries would even out these cost differences, to the benefit of all concerned: those entities able to get lower-priced permits on the international market would have lower compliance costs, and those selling permits internationally would gain more revenue than their own costs of emissions control. Sellers would be acting like the plumber in the example above, providing "emission reduction services" at lower cost than the buyers could achieve on their own.

Even if some Annex B countries do not establish formal emission trading systems domestically, they could still participate in international emission trading. Suppose two countries both establish emissions performance standards for their electicity producers, but the cost of meeting the standards per unit of CO2 reduction is higher in Country B than in Country

A. Electricity producers in Country B could invest in emission-reducing activities in Country A and claim emission reduction credits against which to offset their own costlier-to-reduce emissions. The same kind of transaction could occur if Country A had a low-cost emission performance standards while Country B used a carbon tax with a higher charge per unit of CO2 than the cost in Country A; in this case, producers in Country B would seek a tax rebate for their emission reduction activities in Country A.

This approach, known as "joint implementation" (JI), is less economically efficient than international trade in domestic GHG permits because it is more costly to identify trading opportunities (markets are harder to organize for heterogeneous projects than homogeneous permits). However, Annex B JI is important to consider since it is unlikely in practice that all or even many Annex B countries will establish domestic GHG trading systems, at least initially. Annex B JI allows cost-reducing international trading to bridge across an assortment of domestic compliance options. With appropriate domestic investments in GHG monitoring, *investments that would be needed in any case to comply with the Kyoto Protocol,* GHG trading can be an environmentally credible alternative to domestic compliance.

II. What's So Great About International Emission Trading?

Since emission trading lowers the cost of attaining environmental targets like the Kyoto GHG limits, it avoids the waste of resources. From a political perspective, lower compliance cost makes it politically less difficult to agree to targets.

The cost savings from international GHG trading may be considerable, depending on the amount of gains from trade that the international community allows countries to reap and the organization of the emission reduction markets. Computerized simulation analyses of trading among Annex B countries indicate that under ideal circumstances – no limits on trading volumes and very well-organized markets for emission reductions – the cost savings for the US could be on the order of 50 percent or more. Actual savings are likely to be lower, but the potential still is significant.

A second benefit associated with global emission trading benefit derives from the fact that it separates who pays for emission reductions from who undertakes the reductions. Those countries reductions from who undertakes the reductions. Those countries which find themselves with lower abatement costs and more generous emission ceilings can generate a valuable commodity to export. Emission trading thus can be used to provide financial inducements for participation to those countries that because of lower incomes or other reasons are less eager to join in meeting numerical emission targets. This kind of differentiation was built into the Kyoto Protocol, with Russia and Ukraine even receiving targets in excess of what projected emissions over 2008-2012. In the future, this same approach may lead developing countries to find it advantageous assume national emission limits which provide room for future emissions growth and nearer-term opportunities for emission permit sales to developed countries that generate badly needed investment capital.

III. What's the Downside?

Many criticisms of emission trading are based on philosophical aversion, misunderstanding of the system, or a confusion of means and ends. Some critics believe that it is improper for a rich country to "buy its way" out of its commitments to reduce GHG emissions by purchasing permits from other countries. Some of the debate over supplementarity seems to be based not on the economics of trading, but rather on these philosophical foundations.

A related concern is that if the richer industrialized countries can "get by" through international permits, they will act too slowly to make the long-term changes in their energy and economic systems necessary for sharper future GHG reductions, such as greater energy conservation and more rapid development and spread of new technologies. Whatever the merits of this view (and the thesis is open to debate), it is ultimately a criticism of the emissions targets set for the Annex B countries rather than a criticism of trading per se.

A third criticism is that the effectiveness of a trading system depends on the enforceability of the cap on emissions within all countries trading permits; to the extent that countries lack the necessary institutions or lack the political will to enforce caps, the trading system becomes a sham. While there is merit to this concern, it is also important to remember that problems of monitoring and enforcement exist even without trading. Trading aggravates the problem only to the extent that "bad" permits (in other words, permits that actually are needed domestically to cover emissions) are exported by some sellers without detection or subsequent sanction (we come back to this point below). And since trading can lower compliance costs, it also deters cheating.

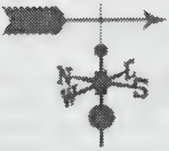
If a country chooses to purchase permits rather than reduce domestic emissions it loses whatever "ancillary benefits" might emerge from co-control of other harmful air pollutants. For example, if a country puts in place GHG control policies that reduce coal combustion, the policy also can reduce emissions of SO2, nitrogen oxides and fine particulates – pollutants that cause health problems and ecological damage. If instead GHG emitters bought permits internationally, they would not reduce their coal combustion and local pollutants so much. However, the size of these ancillary benefits is a subject of ongoing debate, especially as policies for the control of these pollutants become tougher. Moreover, the co-control benefits depend critically on the way GHG policy is imposed – for example, if milder CO2 performance standards were put on older and less efficient coal plants out of political necessity, the ancillary benefits would be reduced.

Another concern is with the large size of the international revenue transfers that might occur from Annex B trading given the Kyoto targets for emissions control. These transfers pose a political problem in that they are likely to flow toward Russia, among other countries, as explained below. They also are may have undesirable economic side effects through their impacts on exchange rates and patterns of trade.

IV. What Issues Loom for COP4 in Buenos Aires?

Emissions trading among Annex B nations will be just one of many contentious issues discussed at Buenos Aires, but it will be one of the most important. Participants in the allowance trading discussion will have to begin to answer five very difficult questions. How these questions are answered will determine in part how robust and effective a GHG emissions trading program can be and how much the cost of meeting the Kyoto targets can be reduced through international trading. The questions are:

- Who gets to trade?
- What is to be traded, and how?
- How many permits can you buy?
- Who is responsible for the commitments implied in the trade?
- Are we buying environmental improvement or just "hot air?"



Who gets to trade?

Article 17 states, "The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3." This seems to make it unambiguously clear that governments (Parties) listed in Annex B may trade permits among themselves (intergovernmental trading). However, governments are not the primary emitters of GHGs. To gain the potential cost savings offered by trading, the trading needs to take place among those most able to take advantage of the trades and undertake the emission reductions needed to free up permits for sale (intersource trading). These are private entities, not governments. Who gets to trade matters since it bears on the cost reduction trading can bring forth. The US leans strongly toward private sector trading. A number of European countries see a greater role for intergovernmental trading and prefer other domestic policy tools like a carbon tax (as noted above, this policy approach does not preclude international private sector emissions trading at the project level).

What is Traded, and How?

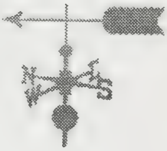
The Kyoto Protocol addresses five other gases in addition to carbon dioxide that have heat-trapping properties in the atmosphere, along with sequestration of carbon dioxide in trees and other "sinks." Aside from questions about how different gases would be traded off against each other in a trading system, emissions of the other gases and of carbon sequestration are much less well measured than carbon dioxide emissions, which can be inferred from fossil fuel use. Even carbon dioxide inventories are poorly measured in a number of countries, raising questions about how trades would be tracked and recorded and how compliance with the Protocol (with or without trading) would be verified. Finally, the actual institutions for trading (such as brokerage services) must emerge.

How Much can you Buy?

Article 6 of the Protocol states, "The acquisition of emission reduction units shall be supplemental (emphasis added) to domestic actions for the purposes of meeting commitments under Article 3." This implies that a Party should undertake some domestic emission reductions and not seek to meet its obligation by simply purchasing the reductions elsewhere. The issue is, how much domestic action is enough?

Who is Responsible? – Caveat Emptor, Caveat Vendor

For a permit that is sold to be valid it must be surplus to the domestic emissions of the selling country. In the US sulfur trading program the seller is held liable (*caveat vendor*) for the integrity (validity) of the permits sold. If such a seller liability system were put in place for international GHG emissions trading, a country purchasing allowances would not have to worry whether the country selling the allowances actually met its commitment under the protocol. If the selling country did not have permits equal to its emissions, sanctions could be imposed on the seller and the buyer would still be able to use the purchased allowances to offset its emissions. Under such a scheme all permits would be worth the same regardless of who sold them.



In a buyer beware system (*caveat emptor*), default on the part of a seller would make some or all of the permits sold by the defaulting party invalid and not usable to offset emissions in the buyer country. Under a buyer beware system, allowances would have different risks and thus different prices depending on the seller's reputation. Buyer liability increases the environmental performance of the system by reducing the probability of invalid permits circulating, but it also considerably increases the cost of participating in the trading system. This in turn reduces the incentive to trade and raises the overall cost of compliance. Different countries and stakeholders are taking different positions on this tradeoff between compliance cost and environmental assurance.

Environmental Improvement or "Hot Air"?

In 1990, prior to the break-up of the former Soviet Union (FSU), the emissions of GHG gases by the member states of the FSU were high. After the break-up and the severe decline in economic activity that followed, emissions fell and are today at quite low levels relative to 1990. The Protocol sets the commitments for Russia and Ukraine at 100% of their 1990 emission levels. Projections to 2010 suggest that FSU emissions will still be below 1990 levels by then. This means that these countries could have a considerable block of surplus permits to sell – if they were permitted to do so. This block of allowances has been termed "hot air" by critics, including many in Europe, who are eager that it not be traded on a global basis. The US and some other countries argue that the assigned amounts were agreed upon by all Parties, and therefore that permits based on these amounts are as good as any others for trade. As noted previously, this is as much as debate over the targets themselves as it is over the mechanism.

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FEATURE

The Clean Development Mechanism: A Primer

By Michael Toman and Marina Cazorla

I. Introduction

The Clean Development Mechanism (CDM) is one of several "flexibility mechanisms" authorized in the December 1997 Kyoto Protocol to the 1992 United Nations Framework Convention on Climate Change (signed at the Rio de Janeiro "Earth Summit"). The Kyoto Protocol specified legally binding commitments by most industrialized countries to reduce their collective greenhouse gas (GHG) emissions by at least 5% compared to 1990 levels by the period 2008-2012. With the goal of reaching these targets at the lowest possible cost for countries that committed to reductions, the Protocol created two flexibility mechanisms, GHG emissions trading and CDM. The CDM is also intended to be an opportunity for developing countries that did not accept binding emissions reductions at Kyoto to be involved in GHG mitigation.

The second section of this paper introduces the CDM's purpose, mandate and institutional structure as authorized in the Kyoto Protocol. The third section focuses on the principal technical and administrative issues that will arise as the CDM is designed and implemented. The last section discusses some of the main unresolved issues with the CDM that confront the Conference of Parties to the Framework Convention.

II. The Kyoto Protocol and Article 12: Organization and Purpose of the CDM

The CDM was created as a successor to "Joint Implementation" (JI). JI consists of a bilateral agreement between two entities to complete a GHG mitigation project. The investor is from an "Annex B" industrialized country that must reduce its emissions under the Framework Convention.

JI potentially can provide credit for emissions abatement to the investor at a lower cost than domestic abatement. In other words, JI is a form of "emissions trading." At the same time, a developing country host can benefit from new investment that increases economic productivity and may reduce local environmental problems. Under the Kyoto Protocol, JI projects still can be undertaken between entities in Annex B industrialized countries (as specified in Articles 3 and 4). However, collaborative projects to reduce emissions or sequester carbon in developing countries are now to occur through the CDM.

Article 12 of the Kyoto Protocol identifies three specific goals for the CDM: (1) to assist in the achievement of sustainable development, (2) to contribute to the attainment of the environmental goals of the Framework Convention, and (3) to assist Annex B parties in complying with their emissions reduction commitments. In particular, Article 12 specifies that developing countries are to benefit from CDM projects resulting in "certified emission reductions" (CERs) and that industrialized countries may use CERs to comply with their quantified emissions reduction commitments under the Kyoto Protocol. Essentially, this allows for voluntary projects similar to previous JI projects between Annex B and non-Annex B countries. The difference is that unlike previous JI projects, CERs are specifically authorized to apply to Annex B emissions reduction targets.

Article 12 establishes three bodies to oversee the CDM: the representatives of the Conference of Parties (COP), an executive board established by the COP, and independent auditors to verify project activities. However, the Protocol provides almost no guidance on what exactly the CDM would do or how it would operate. Instead, the structure and authority of supervisory bodies and the CDM are left for future negotiation.

III. CDM Design Issues

In order for CERs to be created from CDM projects, a number of overlapping technical, regulatory, project finance and administrative functions must be performed. Before any CDM project can be established, there must be demand for CDM projects and CERs; developing countries' concerns about uneven bargaining positions during project contract negotiations must be addressed; liability must be assigned, and insurance procured; project financing also must be obtained; and the benefits of projects must be allocated among participants. It is important to bear in mind that the CDM is a form of *market*, one in which valuable goods and services are to be bought and sold. Many of these functions may be most effectively undertaken by private markets or existing international institutions; the key question is what functions need to be undertaken by new CDM institutions.

Criteria for selection of projects. CDM projects must presumably fulfill certain criteria in order to be certified upon completion, but these criteria have not yet been established. Possible criteria include: method or extent of technology transfer; specific performance or design standards for transferred technology; capacity and willingness of both national and local governments to host the project; existence and nature of agreements for sharing project benefits (CERs and financial returns) and project liability between investor and host; and limits on local environmental or other social impacts. A particularly important question is what criteria might be established for determining "sustainable development" and other benefits for host countries. Another important question is whether references to "emission reductions" in Article 12 are interpreted as allowing or precluding carbon sequestration projects under the CDM.

Project review and CER calculation (before implementation). Prior to the initiation of projects, the "baseline" or previous amount of carbon emissions from the project facility or area in question must be established. The baseline is used to show that purported GHG reductions are "additional" to what otherwise would have occurred. One practical question that arises in assessing additionality is the issue of "project leakage" – when a particular project lowers emissions, but emissions rise in other parts of the host country economy (or elsewhere). This could happen, for example, if a reforestation project in one location was accompanied by greater deforestation elsewhere. There are a variety of options for defining project-level baselines to assess additionality. These include detailed project-level review of projected emissions with and without the project, and streamlined formula-based approaches that estimate emission reductions based on easily observed project characteristics (for example, conversion of a coal power plant to natural gas). Another approach would involve the host country establishing and enforcing "top-down" national or sectoral baselines in an effort to limit leakage, and then assigning shares of the baseline to different emission sources much as emission allowances are allocated in the US program for sulfur dioxide trading among power plants. In this case the validity of the CERs generated from a specific project would depend in part on overall sectoral emissions.

Project monitoring and CER assessment (after implementation). Related to the issue of additionality are technical questions regarding how to measure, monitor and verify the outcomes of individual projects. Both emission reduction and carbon sequestration projects pose their own measurement and monitoring challenges. In either case, some independent entity must intermittently monitor the emissions or sequestration of the project in order to ensure that the benefits of the project accrue over time as represented by project participants. In turn, standards for the accreditation of the certifiers are needed in order to ensure certifier objectivity and credibility.

Rules for CER validity and project liability. For CERs to be credible, there must be rules defining when CERs can be used and assigning legal responsibility in the event that a CDM project is found not to generate the amount of emission reduction promised (either because of misrepresentation before the fact or less than expected performance after the fact). Liability is of less concern if CERs can be used only after an independent (and honest) auditor has certified their existence. If this were the case, prospective credits would be held in abeyance between certifications; the project participants would have to trade off the value of more rapid certification against the cost. If, however, credits can be used in advance of certification, as is the case in some US emission credit trading programs, then questions of after-the-fact liability do arise. Under the Kyoto Protocol, Annex B countries have ultimate responsibility for noncompliance if credits are disallowed. In practice, the assignment of liability to Annex B investors/CER buyers is likely to be efficient since buyers have a financial and reputational stake in CDM projects, possess the resources for effective project oversight, and face enforceable emission ceilings in their own countries. CERs could be transferred to subsequent purchasers without reassignment of liability in order to protect incentives for trading.

Recording of CER exchanges and resulting changes in Annex B parties' accounts. Some institution must be responsible for accounting for newly created CERs, CER exchanges or transactions, and the application of CER credits to Annex B parties' GHG emissions obligations.

Marketing, information, financing, and insurance services. If the CER market is designed reasonably well, most prospective investors are likely have access to market financing for well-designed CDM projects. In some cases, however, institutions like the World Bank might need to provide assistance in identifying and providing financing. Insurance against project failure is another important financial or brokerage service, which again could be provided by the private sector or in some cases by multilateral institutions. Finally, market institutions need to be developed for facilitating transactions in CERs as well as "derivative" transactions, such as options to buy or sell CERs in the future. These institutions would serve as a clearinghouse for secondary trades by matching buyers and sellers, and could also be a repository for "banked" or unused CERs. Such institutions would also facilitate exchanges between CERs and emission permits emerging from Annex B trading.

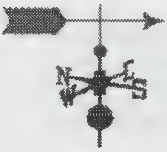
Providing negotiating support for non-Annex B countries. Some developing countries might avoid participation in CDM projects out of fear of possible exploitation by investors due to lack of capacity to negotiate fair contracts. These countries are concerned about the relationship between the CDM and international development assistance, the under-development of the private sector in some developing countries, the lack of developing country capacity to monitor and verify projects independently, and the possibility that investors will take advantage of their lack of technical expertise in project evaluation. The CDM or other institutions could assist by providing access to experienced negotiators and offering training or capacity-building services. However, undertaking these tasks requires a resolution of potential conflicts of interest among the roles of project promoter, host country advocate, and neutral market supporter.

CDM fund administration. Article 12 stipulates that "a share of proceeds from certified project activities [should be] used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation." The COP must still determine how funds will be drawn from CDM projects or CER trading, how large the fund should be, and how proceeds would be disbursed. The question of how funds are raised is of particular interest. If the funding mechanism is based on the proceeds of the project (either direct financial payment or diversion of a share of CERs to a central fund), then in negotiation investors will reduce their willingness to provide benefits to the host country accordingly in order to ensure that the net return on the project remains commensurate with other rates of return throughout the global capital market. In this case the CDM fund would simply be redistributing proceeds among non-Annex B countries. An alternative would be to levy a fixed annual registration fee on any investor interested in being eligible for participation in the CDM.

IV. Key Decisions on CDM Structure and Function

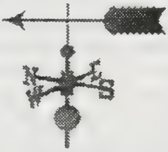
There are several ways the CDM could be structured to address project selection, finance and implementation. The CDM could be more centralized and active in CER market operation, playing a role similar to that of the World Bank or the Global Environment Facility (GEF) in screening, selecting, financing, and assisting in implementation of projects. The CDM also could be a market maker, seeking out host countries from whom to acquire credits and reselling them. However, a key question with a more centralized alternative is the extent to which the CDM would have a comparative advantage in carrying out all these functions, especially if by international agreement it became the only entity eligible to carry out these various functions. Experience suggests that many of the functions enumerated above can be carried out more efficiently by the private sector, and that exclusive control over the functioning of a market does not promote market efficiency or adaptability.

Another alternative would be very similar to Joint Implementation, in which an industrialized country and a developing country agree to collaborate on a CDM project which is later certified by an independent auditor. This arrangement would imply a much smaller role for the CDM, one mostly involving definition of basic criteria for project selection and implementation, general oversight of audits and recording of CER exchanges. This system likely is the most dynamic and flexible, with individual actors in the market (investors, financiers, and others) defining the functioning of the CER market through "learning by doing." How successful this approach would be in terms of accountability would depend on the criteria used for project selection and implementation and the quality of oversight applied.



There is a broad debate over the issue of "supplementarity." The Kyoto Protocol refers to the use of international emissions trading (and by extension the CDM) as being "supplemental" to domestic actions. Supplementarity constraints reflect a concern by some Annex B countries that participation in international flexibility mechanisms will limit the scope and stringency of domestic policies, thus retarding the long-term development of technology and improved energy efficiency needed to achieve and go beyond the Kyoto goals. The other side of that argument is that limits on trading and CDM are blunt instruments to improve the credibility of a nation's commitment to the Kyoto Protocol, and that by increasing the overall cost of compliance with the Protocol the restrictions also contribute to lack of willingness to achieve the target reductions.

Finally, there are inherent tensions among the goals for the CDM articulated in Article 12 of the Kyoto Protocol. For example, a more formulaic approach to project review would lower "transactions costs," but it might also decrease the accuracy of the assessment of additionality. Greater efforts to extract benefits for non-Annex B countries or to reduce uncertainty in the measurement of CERs will increase participation costs for Annex B countries and thereby reduce their interest in participation. To illustrate, requiring selection of the best available abatement technologies might facilitate technological "leapfrogging" by LDCs but would also raise the cost of the project. These tradeoffs and their consequences are the reason why the design of CDM institutions and projects must be considered carefully before implementation. Since early (pre-2008) reductions through the CDM are possible under the Protocol starting in 2000, there is little time to spare in settling some of these basic issues.



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FEATURE

International Emissions Trading

By Raymond Kopp and Michael Toman

OCTOBER 1, 1998 -- Emissions trading is one of the key "flexibility mechanisms" built into the Kyoto Protocol negotiated among 168 governments in December 1997. Supporters of trading argue that it will greatly reduce the overall costs of complying with the reductions in greenhouse gas emissions that the Kyoto Protocol would require. But the rules for a trading system have yet to be worked out, and skeptics question its potential efficacy.

The issue is likely to be one of the main subjects at the next international negotiation session on global warming, which begins Nov. 1 in Buenos Aires. In the United States, the Clinton administration has said that it will not send the Kyoto Protocol to the Senate for ratification until, among other conditions, the provisions for trading are explicit.

In addition to technical issues of administration and enforcement, international emissions trading raises substantial economic and political questions. The Clinton administration is using cost estimates implying that the United States intends to buy abroad as much as 85 per cent of the permits it would need to comply with the Kyoto reductions, instead of making those reductions in the American domestic economy. But in the section (Article 17) in which the Kyoto text authorizes trading, it adds that this trading "shall be supplemental to domestic actions." Some negotiators from other regions, particularly Europe, have questioned whether the American intentions meet the "supplementarity" test of the Kyoto language, and they have proposed limits on the use of international trading that would drive up compliance costs for the US and other countries.

Emissions trading is a mechanism for use among the "Annex B" industrialized countries, basically the OECD (minus South Korea and Mexico) plus the countries of the former Soviet Union and Eastern Europe. All of these countries have numerical emission limits in the Kyoto Protocol to be reached by 2008-2012. Another flexibility mechanism in the Kyoto Protocol, the "Clean Development Mechanism" (CDM), involves transactions between Annex B countries and developing countries that do not have national emission limits. The CDM is discussed in a companion to this paper. Developing countries also could opt into the trading system voluntarily by assuming national limits.

How Would a Trading System Work?

One of the most important tenets of economics has to do with the "gains from trade." Any exchange of one set of goods and services for another must benefit all parties for the trade to succeed.

To understand the gains from trading emission permits, consider a homeowner who wakes up one morning to find broken water pipes in the bathroom and water gushing all over the floor. The homeowner could stay home and fix the pipes but that would mean losing a day's pay at work. Instead, the homeowner realizes it is cheaper to pay a professional plumber to fix the pipes and for the homeowner to go to work. In this case, both the homeowner and the plumber can fix the pipes, but the plumber can do it cheaper so both parties benefit if the homeowner pays the plumber.

Trading greenhouse gas emission permits is akin to the plumbing example, in that those buying emission "permits" or "credits" actually are paying someone else to reduce emissions who can do it more cheaply than they can. Internationally, this can occur in a couple of distinct ways. One possibility is that Annex B countries could establish domestic emission trading programs to meet their Kyoto obligations. In the absence of emissions trades among countries, the prices of emission permits could differ. This would mean that the incremental cost of emission control would be higher in the countries with higher permit prices. International trade in the domestic permits of different countries would even out these cost differences, to the benefit of all concerned: those entities able to get lower-priced permits on the international market would have lower compliance costs, and those selling permits internationally would gain more revenue than their own costs of emissions control. Sellers would be acting like the plumber in the example above, providing "emission reduction services" at lower cost than the buyers could achieve on their own.

Even if some Annex B countries do not establish formal emission trading systems domestically, they could still participate in international emission trading. Suppose two countries both establish emissions performance standards for their electicity producers, but the cost of meeting the standards per unit of CO2 reduction is higher in Country B than in Country A. Electricity producers in Country B could invest in emission-reducing activities in Country A and claim emission reduction credits against which to offset their own costlier-to-reduce emissions. The same kind of transaction could occur if Country A had a low-cost emission performance standards while Country B used a carbon tax with a higher charge per unit of CO2 than the cost in Country A; in this case, producers in Country B would seek a tax rebate for their emission reduction activities in Country A.

This approach, known as "joint implementation" (JI), is less economically efficient than international trade in domestic GHG permits because it is more costly to identify trading opportunities (markets are harder to organize for heterogeneous projects than homogeneous permits). However, Annex B JI is important to consider since it is unlikely in practice that all or even many Annex B countries will establish domestic GHG trading systems, at least initially. Annex B JI allows cost-reducing international trading to bridge across an assortment of domestic compliance options. With appropriate domestic investments in GHG monitoring, *investments that would be needed in any case to comply with the Kyoto Protocol,* GHG trading can be an environmentally credible alternative to domestic compliance.

What's So Great About International Emissions Trading?

Since emission trading lowers the cost of attaining environmental targets like the Kyoto GHG limits, it avoids the waste of resources. From a political perspective, lower compliance cost makes it politically less difficult to agree to targets.

The cost savings from international GHG trading may be considerable, depending on the amount of gains from trade that the international community allows countries to reap and the organization of the emission reduction markets. Computerized simulation analyses of trading among Annex B countries indicate that under ideal circumstances – no limits on trading volumes and very well-organized markets for emission reductions – the cost savings for the US could be on the order of 50 percent or more. Actual savings are likely to be lower, but the potential still is significant.

A second benefit associated with global emission trading benefit derives from the fact that it separates who pays for emission reductions from who undertakes the reductions. Those countries which find themselves with lower abatement costs and more generous emission ceilings can generate a valuable commodity to export. Emission trading thus can be used to provide financial inducements for participation to those countries that because of lower incomes or other reasons are less eager to join in meeting numerical emission targets. This kind of differentiation was built into the Kyoto Protocol, with Russia and Ukraine even receiving targets in excess of what projected emissions over 2008-2012. In the future, this same approach may lead developing countries to find it advantageous assume national emission limits which provide room for future emissions growth and nearer-term provide room for future emissions growth and nearer-term opportunities for emission permit sales to developed countries that generate badly needed investment capital.

What's the Downside?

Many criticisms of emission trading are based on philosophical aversion, misunderstanding of the system, or a confusion of means and ends. Some critics believe that it is improper for a rich country to "buy its way" out of its commitments to reduce GHG emissions by purchasing permits from other countries. Some of the debate over supplementarity seems to be based not on the economics of trading, but rather on these philosophical foundations.

A related concern is that if the richer industrialized countries can "get by" through international permits, they will act too slowly to make the long-term changes in their energy and economic systems necessary for sharper future GHG reductions, such as greater energy conservation and more rapid development and spread of new technologies. Whatever the merits of this view (and the thesis is open to debate), it is ultimately a criticism of the emissions targets set for the Annex B countries rather than a criticism of trading per se.

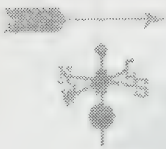
A third criticism is that the effectiveness of a trading system depends on the enforceability of the cap on emissions within all countries trading permits; to the extent that countries lack the necessary institutions or lack the political will to enforce caps, the trading system becomes a sham. While there is merit to this concern, it is also important to remember that problems of monitoring and enforcement exist even without trading. Trading aggravates the problem only to the extent that "bad" permits (in other words, permits that actually are needed domestically to cover emissions) are exported by some sellers without detection or subsequent sanction (we come back to this point below). And since trading can lower compliance costs, it also deters cheating.

If a country chooses to purchase permits rather than reduce domestic emissions it loses whatever "ancillary benefits" might emerge from co-control of other harmful air pollutants. For example, if a country puts in place GHG control policies that reduce coal combustion, the policy also can reduce emissions of SO2, nitrogen oxides and fine particulates – pollutants that cause health problems and ecological damage. If instead GHG emitters bought permits internationally, they would not reduce their coal combustion and local pollutants so much. However, the size of these ancillary benefits is a subject of ongoing debate, especially as policies for the control of these pollutants become tougher. Moreover, the co-control benefits depend critically on the way GHG policy is imposed – for example, if milder CO2 performance standards were put on older and less efficient coal plants out of political necessity, the ancillary benefits would be reduced.

Another concern is with the large size of the international revenue transfers that might occur from Annex B trading given the Kyoto targets for emissions control. These transfers pose a political problem in that they are likely to flow toward Russia, among other countries, as explained below. They also are may have undesirable economic side effects through their impacts on exchange rates and patterns of trade.

What Issues Loom for COP-4 in Buenos Aires?

Emissions trading among Annex B nations will be just one of many contentious issues discussed at Buenos Aires, but it will be one of the most important. Participants in the allowance trading discussion will have to begin to answer five very difficult questions. How these questions are answered will determine in part how robust and effective a GHG emissions trading program can be and how much the cost of meeting the Kyoto targets can be reduced through international trading. The questions are:



- Who gets to trade?
- What is to be traded, and how?
- How many permits can you buy?
- Who is responsible for the commitments implied in the trade?
- Are we buying environmental improvement or just "hot air?"

Who gets to trade? Article 17 states, "The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3." This seems to make it unambiguously clear that governments (Parties) listed in Annex B may trade permits among themselves (intergovernmental trading). However, governments are not the primary emitters of GHGs. To gain the potential cost savings offered by trading, the trading needs to take place among those most able to take advantage of the trades and undertake the emission reductions needed to free up permits for sale (intersource trading). These are private entities, not governments. Who gets to trade matters since it bears on the cost reduction trading can bring forth. The US leans strongly toward private sector trading. A number of European countries see a greater role for intergovernmental trading and prefer other domestic policy tools like a carbon tax (as noted above, this policy approach does not preclude international private sector emissions trading at the project level).

What is Traded, and How? The Kyoto Protocol addresses five other gases in addition to carbon dioxide that have heat-trapping properties in the atmosphere, along with sequestration of carbon dioxide in trees and other "sinks." Aside from questions about how different gases would be traded off against each other in a trading system, emissions of the other gases and of carbon sequestration are much less well measured than carbon dioxide emissions, which can be inferred from fossil fuel use. Even carbon dioxide inventories are poorly measured in a number of countries, raising questions about how trades would be tracked and recorded and how compliance with the Protocol (with or without trading) would be verified. Finally, the actual institutions for trading (such as brokerage services) must emerge.

How Much Can You Buy? Article 6 of the Protocol states, "The acquisition of emission reduction units shall be supplemental (emphasis added) to domestic actions for the purposes of meeting commitments under Article 3." This implies that a Party should undertake some domestic emission reductions and not seek to meet its obligation by simply purchasing the reductions elsewhere. The issue is, how much domestic action is enough?

Who is Responsible? -- Caveat Emptor, Caveat Vendor. For a permit that is sold to be valid it must be surplus to the domestic emissions of the selling country. In the US sulfur trading program the seller is held liable (*caveat vendor*) for the integrity (validity) of the permits sold. If such a seller liability system were put in place for international GHG emissions trading, a country purchasing allowances would not have to worry whether the country selling the allowances actually met its commitment under the protocol. If the selling country did not have permits equal to its emissions, sanctions could be imposed on the seller and the buyer would still be able to use the purchased allowances to offset its emissions. Under such a scheme all permits would be worth the same regardless of who sold them.

In a buyer beware system (*caveat emptor*), default on the part of a seller would make some or all of the permits sold by the defaulting party invalid and not usable to offset emissions in the buyer country. Under a buyer beware system, allowances would have different risks and thus different prices depending on the seller's reputation. Buyer liability increases the environmental performance of the system by reducing the probability of invalid permits circulating, but it also considerably increases the cost of participating in the trading system. This in turn reduces the incentive to trade and raises the overall cost of compliance. Different countries and stakeholders are taking different positions on this tradeoff between compliance cost and environmental assurance.

Environmental Improvement or "Hot Air"? In 1990, prior to the break-up of the former Soviet Union (FSU), the emissions of GHG gases by the member states of the FSU were high. After the break-up and the severe decline in economic activity that followed, emissions fell and are today at quite low levels relative to 1990. The Protocol sets the commitments for Russia and Ukraine at 100% of their 1990 emission levels. Projections to 2010 suggest that FSU emissions will still be below 1990 levels by then. This means that these countries could have a considerable block of surplus permits to sell – if they were permitted to do so. This block of allowances has been termed "hot air" by critics, including many in Europe, who are eager that it not be traded on a global basis. The US and some other countries argue that the assigned amounts were agreed upon by all Parties, and therefore that permits based on these amounts are as good as any others for trade. As noted previously, this is as much as debate over the targets themselves as it is over the mechanism.

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FEATURE

Carbon Sinks in the Post-Kyoto World: Part I

By Roger Sedjo, Brent Sohngen and Pamela Jagger

OCTOBER 2, 1998 -- The Kyoto Protocol prepared in December 1997 contained several defining features. It provides for legally-binding emissions targets for Annex I (industrial) countries, although no targets are required for developing countries. Additionally, it recognizes human-induced carbon sequestration as a way of meeting legally binding greenhouse gas emissions targets.

The Protocol specifically mentions emissions from sources and removals by sinks resulting from direct human-induced land-use change and forest related activities – deforestation, reforestation and afforestation – undertaken since 1990. However, the Protocol is silent on the role of other sinks in meeting national emission inventories. Agricultural land, for example, is mentioned as a possible carbon source which must be included in a country's emission inventory (see Annex A of the Protocol), but there are no provisions for national credits for the buildup of the agricultural soil carbon sink. However, Article 3.4 of the Protocol appears to allow for expansion of recognized human-induced sink activities. Finally, the Protocol is largely silent on how such credits would be calculated or verified.

In this essay, we first review some basic concepts related to the definition of carbon sinks, the functioning of forest ecosystems as sinks, and forest-related activities that change carbon balances. We then examine briefly trends in global forests that affect their carbon balances. Following this discussion, we review some of the questions that must be addressed in defining an effective system of forest carbon sequestration credits as part of a national strategy for meeting emission reduction targets. Next, we point out several ways in which the Kyoto Protocol is ambiguous as it applies to carbon sinks and sink credits. Finally, we discuss some broad concepts and practices with respect to carbon sequestration and forest-based carbon credits.

Global Carbon Sinks:

Some Basic Concepts

Global carbon is held in a variety of different stocks. Natural stocks include oceans, fossil fuel deposits, the terrestrial system and the atmosphere. In the terrestrial system carbon is sequestered in rocks and sediments, in swamps, wetlands and forests, and in the soils of forests, grasslands and agriculture. About two-thirds of the globe's terrestrial carbon, exclusive of that sequestered in rocks and sediments, is sequestered in the standing forests, forest understory plants, leaf and forest debris, and in forest soils. In addition, there are some non-natural stocks. For example, long-lived wood products and waste dumps constitute a separate human-created carbon stock. Given increased global timber harvests and manufactured wood products over the past several decades, these carbon stocks are likely increasing as the carbon sequestered in long-lived wood products and waste dumps is probably expanding.

A stock that is taking-up carbon is called a "sink" and one that is releasing carbon is call a "source." Shifts or flows of carbon over time from one stock to another, for example, from the atmosphere to the forest, are viewed as carbon "fluxes." Over time, carbon may be transferred from one stock to another. Fossil fuel burning, for example, shifts carbon from fossil fuel deposits to the atmospheric stock. Physical processes also gradually convert some atmospheric carbon into the ocean stock. Biological growth involves the shifting of carbon from one stock to another. Plants fix atmospheric carbon in cell tissues as they grow, thereby transforming carbon from the atmosphere to the biotic system.

The amount of carbon stored in any stock may be large, even as the changes in that stock, fluxes, are small or zero. An old-growth forest, which is experiencing little net growth, would have this property. Also, the stock may be small while the fluxes may be significant. Young fast-growing forests tend to be of this type. The potential for agricultural crops and grasses to act as a sink and sequester carbon appears to be limited, due to their short life and limited biomass accumulations. However, agricultural and grassland soils have substantial potential to sequester carbon. Their role for human management of carbon could increase as we learn more about their characteristics and new approaches, conservation tillage for example, are introduced.

How Forest Ecosystems Act as Sinks

Oceans, soils and forests all offer some potential to be managed as a sink, that is, to promote net carbon sequestration. The role of forests in carbon sequestration is probably best understood and appears to offer the greatest near-term potential for human management as a sink. Unlike many plants and most crops, which have short lives or release much of their carbon at the end of each season, forest biomass accumulates carbon over decades and centuries. Furthermore, carbon accumulation potential in forests is large enough that forests offer the possibility of sequestering significant amounts of additional carbon in relatively short periods – decades. However, forest carbon can also be released fairly quickly, as in forest burning.

Fortuitously, forests managed for timber, wildlife or recreation have as a by-product carbon sequestration. Forests may also be managed strictly to sequester carbon. Such a focus on biomass accumulation could provide a somewhat reduced amount of other forest ecosystem services such as biodiversity. However, if forests managed for carbon sequestration are allowed to mature and remain unharvested, one of the long-term effects may be enhanced biodiversity.

There are four components of carbon storage in a forest ecosystem. These are trees, plants growing on the forest floor (understory material), detritus such as leaf litter and other decaying matter on the forest floor, and forest soils. Carbon is sequestered in the process of plant growth as carbon is captured in plant cell formation and oxygen is released. As the forest biomass experiences growth, the carbon held captive in the forest stock increases. Simultaneously, plants grow on the forest floor and add to this carbon store. Over time, branches, leaves and other materials fall to the forest floor and may store carbon until they decompose. Additionally, forest soils may sequester some of the decomposing plant litter through root/soil interactions.

Forest transitions from one ecological condition to another will produce substantial carbon flows – forests can be a carbon source or a sink. It is important to carefully assess exactly what is happening to the carbon as the forest changes to determine the forest's sink/source contribution. Net forest carbon may be released, thereby making the forest a source, due to biomass reductions from fire, tree decomposition, or logging, any of which will reduce the forest biomass. In the case of decomposition or fire, forest carbon is released into the atmosphere. However, the forest may again become a carbon sink as it is restored through forest regrowth.

In much of the world wood is used as a source of energy and this burning will release carbon into the atmosphere. Where the fuelwood is taken from a forest and regrowth occurs, no net carbon is emitted. Furthermore, to the extent that biofuels are produced sustainably and used as a substitute for fossil fuel energy, fossil fuel emissions are avoided and no new net carbon emissions are created, since biofuel regrowth offsets the initial biofuel emissions.

Deforestation, Reforestation and Afforestation

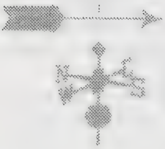
Deforestation occurs when forestland is cleared and reforestation does not take place. Commonly, land clearing is associated with the permanent conversion of forestlands to other uses, such as croplands, pasture or development. When forest is converted to some other use, there is a net loss of carbon in the terrestrial stock since most other land uses will sequester less carbon than the forest. Under these circumstances net carbon transfers occur. If the site is cleared and the vegetation burned, most of the carbon is released into the atmosphere. However, to the extent that the vegetation is converted into long-lived wood products or substituted for fossil fuel energy, only a portion of the carbon in the forest will be a net release into the atmosphere.

Although reforestation typically refers to the practice of re-establishing a forest on a site that has recently been harvested, it may also refer to the re-establishment of forest on a site that has been cleared for some period of time. In either case, reforestation acts as a carbon sink since it results in the build-up of carbon stocks in the newly established biomass.

The creation of a forest on land never forested or not forested for a very long time is called afforestation. Often the distinction between afforestation and reforestation blurs as the period during which the forest has been absent from the land lengthens. Afforestation occurs when forests are established on grasslands, never previously forested. It may also be said to occur as lands once in forests, but which have been in agriculture for long periods of time as in parts of the US South, are converted into forests, due to either natural processes or tree planting. On afforested lands the additional carbon stored in trees and other components of the forest ecosystem constitutes a net addition to the terrestrial forest stock.

Forest Management and Natural Disasters

Commercial timber harvests are typically accompanied by reforestation, whether natural or human induced, although land use conversion away from forests to other uses, primarily agriculture and pasture, are still common in the tropics. When commercial harvests are accompanied by reforestation, the land-clearing effects of the harvest on the forest carbon stocks are offset, in the long term, by carbon sequestration and the build-up of carbon stocks in the newly regenerated forest. The long term change in carbon storage will depend directly on the type and volumes of forest harvested and regenerated. In some cases second growth forest will not sequester as much carbon as the original forest. For instance, when old-growth forest is harvested, the replacement forest will typically involve less volume, especially if it is being managed for timber harvests. However, when storage in long-lived wood products is considered the net carbon of the managed replacement forest and its products will more closely approach that of the initial forest over a longer period.



Forest management can contribute to carbon sequestration through promoting forest growth and biomass accumulation. Additionally, management can choose to extend the harvest rotation, thereby increasing the average forest stock and hence the average carbon sequestered in a forest.

Finally, natural disasters can impact forest stocks and often result in forests becoming a carbon source – at least for a time. Large portions of the world's natural forests are subject to natural disturbances, which occur periodically as part of natural cycles. Forest are subject to substantial carbon-releasing disturbances, particularly in the form of wildfires, which often occur after the forest is first disturbed by other forces such as drought, disease or pests. Natural disasters may release large amounts of carbon in a short period of time. However, where land is not converted to other uses, the forest typically re-establishes itself and again begins to sequester carbon. In many forests natural disturbance regimes create a cyclical pattern of growth (sequestration), disturbance (emission) and regrowth (sequestration) over period of many hundreds of years.

World Forests: The Existing Situation

Although it is well known that the world's tropical forests are declining, it is less widely recognized that the world's temperate and boreal forests have been expanding, albeit modestly. Thus, while the tropical forest carbon stock has become smaller, the temperate/boreal forest has been expanding. Some analysts believe that the failure to fully account for the sources of all of the carbon build-up in the atmosphere, the "missing carbon sink," is explained by the expanding the forests of the Northern Hemisphere. However, since the Protocol limits carbon credits to "human-induced" activities, it is unlikely that Northern Hemisphere countries will get credit for this missing sink, even if forest expansion occurs within their national boundaries.

Nevertheless, overall, the size of the global forest carbon stock appears to be declining, thereby generating a net carbon source. However, while forest decline contributes to the build-up in atmospheric carbon, analysts widely agree that the primary cause of the build-up in atmospheric carbon is not attributable to land use changes, but rather is due largely to fossil fuel burning and its associated emissions.

Click here for Part II of this essay.

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FEATURE

Carbon Sinks in the Post Kyoto World: Part II

**By Roger Sedjo, Brent Sohngen
and Pamela Jagger**

OCTOBER 2, 1998 --

The Kyoto Protocol and Sinks: Some Unresolved Questions

Article 3 of the Kyoto Protocol to the UN Framework Convention on Climate Change (UNFCCC) focuses on the net change in greenhouse gas emissions by source, and on removals by sinks resulting from direct human-induced land-use change and forestry activities. The national commitments to emission targets of the Annex I countries are articulated in the Protocol and are tied to base-year 1990 emission levels. The sink changes that can be considered for meeting the commitments in the national emission inventories under the Protocol are limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period. Initially, only sink accumulations *during* the 5-year commitment period 2008-2012, will be counted in meeting net emission targets. However, subsequent commitment periods would be contiguous after 2012.

How helpful the inclusion of sinks in the Protocol ultimately will be in assisting a country in meeting its emission targets will depend importantly on how the activities of afforestation, reforestation, and deforestation are ultimately defined for purposes of the Protocol. The language of Article 3.3, however, has been regarded as confusing and complicated and has resulted in different interpretations. Some analysts contend that the apparent omission of forest management, conservation and protection implies that these activities would not qualify as an emission reduction in the future. Others contend that forest management and conservation are encompassed within the terminology – deforestation, reforestation, and afforestation. Article 6, which mentions that projects can be developed in "any sector of the economy," could be interpreted as indicating that conservation and forest management could qualify for emission reduction credit. One problem with including forest conservation is that Article 3.3 states that the activity needs to be measured as a verifiable change in stock. It is not clear how much of what is considered conservation and protection would produce positive changes in verifiable stocks. It may simply protect stocks that already exist. However, much of conservation's contribution to carbon sequestration is captured in reducing deforestation, and thereby reducing the accumulation of new debits in national emissions inventories.

The Protocol provides for countries to gain credit toward their Protocol requirements through afforestation and reforestation that were undertaken after 1990 on lands that, prior to 1990, were not forested. However, countries that are net carbon emitters from their forestry sector may lose credits since, under the Protocol, countries must count the carbon activity, positive or negative, on land on which the designated forestry activities have occurred since 1990.

The question of how commercial timber harvests are to be treated is also unclear in the Protocol. One interpretation is that harvesting simply has not been included in the Protocol and should be ignored. Alternatively, this issue may depend upon the definitions of forests, deforestation and reforestation. Since most commercial timber harvests involve logging followed by regeneration, often natural-regeneration, one could argue that neither carbon released from commercial harvests nor the carbon sequestered from the re-establishment of a forest and growth after harvest is to be considered for meeting the levels called for in the Protocol. Additionally, Article 3.4 allows for the possible future inclusion of other categories of land use changes and forestry activities. Future categories may be an avenue for eventually including forest management, agricultural soils, and other managed sinks. At this time, however, the interpretation of the Protocol remains unclear.

Another potential role for sinks in the Protocol is through the newly developed Clean Development Mechanism (CDM), which allows projects to be initiated by the developing countries themselves and also allows investments and participation by Annex I countries. It is not yet clear whether Article 3.3, which limits the activities that can provide net changes to be included in Annex I national emission inventories to deforestation, reforestation and afforestation, also applies to projects under the CDM.

Finally, the Kyoto Protocol is almost silent on the role of other sinks in meeting national emission inventories. Although agricultural land is mentioned (in Annex A of the Protocol) as a possible carbon source that must be included in a country's emission inventory, there are no provisions for national credits for the buildup of the agricultural soil carbon sink. There are, however, some provisions of the Protocol (for example, Article 3.4) that might provide credit for additional sink activities.

There are at least five important points to recognize: a) forests are definitely included in the Protocol; b) the Protocol provides for credit for some human induced forest based emission reduction activities begun in 1990 or later; however, c) credits accrue only for carbon sequestered during the 2008-2012 commitment period, d) forest management, conservation, and agricultural soil sinks are not specifically mentioned and hence their role in obtaining credits is currently subject to varying interpretations; and e) it is unclear whether the emerging CDM will allow for broader sink activities. How the CDM is ultimately treated depends on whether it is covered by the same limitation on sink activities as is called for in Article 3.3. Finally, the recent June 1998 Bonn meetings have turned the scientific issues of the Protocol over to the Intergovernmental Panel on Climate Change (IPCC) for clarification with the target of a special report in the year 2000.

Carbon Reduction Credits: Concepts and Practice

In addition to the substantive issues associated with clarifying the language of the Protocol so that forest based emissions credits (debits) can be efficiently incorporated into the portfolio of carbon reduction mechanisms, there are a number of practical issues in need of formalization. Current thinking indicates that carbon sequestration projects under Kyoto will be managed on a project by project basis. What remains to be determined is how issues of baseline determination, additionality, leakage, verification and the potential for perverse incentives to motivate forest management decisions will be addressed. Reconciliation of these issues tops the carbon sequestration agenda. In addition, the costs of afforestation and reforestation, the land use activities that support carbon sequestration, are being estimated with widely divergent results. The cost aspect of forest based carbon sequestration as an offset mechanism is particularly important. It determines how carbon sequestration compares with other potential carbon offset mechanisms in the broader scheme of greenhouse gas reduction policies.

The determination of a baseline by which to assess carbon sequestration is critical as it provides the frame of reference for determining how carbon sequestration projects are contributing to the net carbon sink at either the project or national level. Baseline determination is closely tied to the concern that carbon sequestration activities be 'real and additional', meaning that carbon sequestration for which credits are given as a result of some forestry based activity be over and above that which would have occurred in the absence of an emissions reduction program. Determining business as usual baseline measures of the total stock of carbon for a defined area has thus far proved to be scientifically challenging, particularly in cases where heterogeneous forest ecosystems are the land use being examined. Evidence indicates that the measurement of total carbon is a complex process, and is likely to have very high transaction costs due to the site-specific nature of forest ecosystems. Monoculture plantations appear to offer more straightforward measurement options, likely at much lower costs.

It may not be necessary to evaluate the total terrestrial stock of carbon in a defined area. Instead, one can focus on the carbon flows that result from land use changes in this area over a specified time period. This would allow carbon sequestration to be incorporated into a "cap and trade" policy in which changes in land use that gave rise to increases or decreases in long-term carbon sequestration would be covered as part of the national inventory of carbon flows relative to a national baseline. The alternative of allowing voluntary opt-in of individual carbon sequestration projects provides a less clear-cut determination of overall changes in the carbon stock relative to a previously defined baseline.

A related issue is the "unintended consequences" associated with the development of a carbon sequestration system. Simply focusing on forests for carbon sequestration would probably lead to the almost exclusive establishment of single species tree plantations. As was noted earlier, old growth forest has limited potential for absorbing additional atmospheric carbon. When ecosystem climax levels are reached, old growth forests in effect become neutral, acting primarily as a fixed carbon sink rather than a net sequesterer. Without proper incentives, there exists the possibility that monoculture crops, which are known to sequester carbon rapidly, and thus offer greater short-term carbon storage gains than the previously existing ecosystem, will replace biodiverse heterogeneous forest ecosystems. It is important that in the determination of baselines, either through regulatory enforcement or market-based mechanisms, that the incentives are appropriate to the entire set of social objectives to be met by the forest ecosystem.

Additionally, there is significant potential for locally based emissions reductions to simply shift deforestation and other carbon emitting land use practices to other locations. Leakage is most likely to happen if carbon sequestration is evaluated at the project level, rather than within the more comprehensive framework of a national carbon budget. Again, a cap and trade type of policy, administrated at the national level and requiring the monitoring of total additions and deletions in reference to a defined baseline is a likely option for dealing with leakage issues. The problem of leakage is especially relevant in nations where forested land falls in regions with poorly defined property rights and where large populations rely on forest resources for subsistence needs, particularly shifting cultivation.

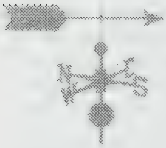
It is clear that issues surrounding baseline determination, additionality and leakage require serious attention. Once measurement issues are resolved and the rules that will address additionality and leakage concerns agreed upon, it is likely that in many cases verification will occur through a neutral third-party. One of the probable institutional frameworks for the verification of forest-based carbon offsets will be third party audits conducted in a similar fashion to those which are currently being undertaken to certify timber harvested from sustainably managed forests. If the scope of carbon sequestration develops to include agriculture and other land uses, institutions established to verify carbon offsets will have to be adapted to accommodate the potentially infinite number of land use portfolios that will contribute to the global carbon stock.

Before carbon sequestration is widely accepted as a policy tool for reducing greenhouse gas emissions, the costs of carbon sequestration must be clarified. When analyzing carbon sequestration based on the opportunity cost of land, proponents of carbon sequestration note that a great deal of forested land is located in remote regions, often characterized by high timber extraction costs due to rugged terrain and limited access. From a financial cost-benefit perspective, the opportunity cost of these forested lands is very low, implying that if tree cover establishment costs are low, the total cost of afforestation or reforestation to establish permanent tree cover will likely be lower than many other carbon offset mechanisms. In addition, these lands are easily viewed as prime candidates for conservation easement programs that will deter deforestation and promote conservation. However, the convention of citing the opportunity cost of land, typically in the form of foregone agricultural rents, as the cost of carbon sequestration often omits important considerations in land-use decision making.

Research is currently underway to more clearly identify the costs of carbon sequestration, taking into account behavioral responses to alternative land-use values. The inclusion of non-market benefits and the consequences of potential irreversibility of land conversion may significantly affect a landowner's willingness to agree to a major land use change that will result in carbon being sequestered. When these factors are considered, the costs of carbon sequestration are often higher than the majority of values generally observed in previous studies (approximately $1-$20 USD per ton). However, many of the higher-cost estimates have been obtained in the US, where the opportunity costs of the land are often significant. Other parts of the world, for example regions of South America, appear to have the potential for lower cost carbon sequestration due in part to the inherently lower opportunity costs of land.

Based on current knowledge for the Annex I nations, afforestation on low cost lands is among the less expensive alternatives when compared with other greenhouse gas reduction policies, particularly in the near to medium term. The low-cost potential may even be greater in some developing countries. Given that reduction of atmospheric CO_2 is a long run goal, carbon sequestration will likely be best used as one of a broader portfolio of carbon offset mechanisms. This carbon-offset portfolio will differ among nations, with developing countries perhaps relying heavily on carbon sequestration offsets in the short to medium term.

Conclusion



The Kyoto Protocol has provided a vehicle for considering the effects of carbon sinks and sources, as well as addressing issues related to fossil fuels emissions. However, the approach of the Kyoto Protocol clearly is not comprehensive in its treatment of sinks, being inherently restrictive in its focus. The Protocol deals only with a small subset of the total carbon fluxes that are generated by selected sinks and sources, limiting its attention to human-induced carbon fluxes dealing with afforestation, reforestation and deforestation undertaken after 1990. Additionally, the approach is further limited by its focus on changes in carbon stocks only in the commitment period of 2008-2012. Thus, the Protocol ignores carbon changes during some periods and from some sources, many human-induced. For example, management and many human-induced actions will generate far more carbon sequestration than credit received. However, the Protocol does have provisions (Article 3.4), for making desired changes through time.

When the on-the-ground logistics of carbon sequestration projects are considered, several issues are still in need of clarification. Project details such as establishing baselines and controlling for leakage, and the institutions that will support project verification are currently being debated. However, carbon sequestration through forest activity has considerable potential to generate low-cost sequestration alternatives, especially in certain developing countries. Nonetheless, care must be taken to recognize the true opportunity costs of alternative land uses and to identify that, in many cases, social values other than carbon sequestration are also involved, and trade-offs are necessary.

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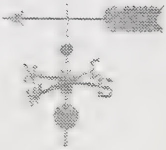

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Foreign Affairs Articles

Toward a Real Global Warming Treaty

Richard N. Cooper

THE CHALLENGE AFTER KYOTO

IN DECEMBER 1997 the world's nations met in Kyoto to grapple with the problem of global warming. The Kyoto conference garnered a wide variety of assessments, ranging from "a notable success" through "a useful first step" to "a grave disappointment and setback" for those concerned with the future of the planet. Whatever one thinks of Kyoto in terms of environmentalist politics, the troubling fact remains that its underlying approach is bound to fail. Because it is premised on setting national emissions targets, the Kyoto strategy will not be able to solve the alleged problem of global climate change resulting from greenhouse gas emissions. The likely failure of Kyoto should be used as the impetus for a hard look at the prospects for a treaty on global climate change.

The Framework Convention on Climate Change signed in 1992 in Rio de Janeiro drew wide international attention to the danger of gradual global warming from humanity's use of fossil fuels and other activities. Rio committed signatory governments to do something about global climate change, but it did not commit them to take any specific actions. Since Rio, governments of most rich countries undertook to reduce their levels of carbon dioxide emissions to estimated 1990 levels—within the relatively near, but unspecified future. In 1995 the rich nations further committed themselves to agree at Kyoto in 1997 on a set of binding emissions targets to last beyond the year 2000.

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Since Rio, actions actually taken to reduce emissions of greenhouse gases—carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons—have not matched stated intentions. Emissions of CFCs have slowed due to the Montreal Protocol of 1987 to protect the ozone layer, and carbon dioxide emissions are growing less quickly because of lower-than-expected economic growth since 1992 in Europe, Japan, and the former Soviet Union. Nevertheless, one projection shows that energy-related carbon dioxide emissions will grow by fully 30 percent between 1990 and 2010.

At Kyoto, the 24 rich members of the Organization of Economic Cooperation and Development (OECD) as of 1992 and the European countries of the former Soviet Union pledged to cut their greenhouse gas emissions by 2010. The reduction targets, which also give credit for planting trees that remove carbon dioxide from the atmosphere, are eight, seven, and six percent below 1990 emission levels for the European Union, the United States, and Japan, respectively. Such reductions will be difficult to achieve, at least for the United States, whose emissions are otherwise expected to grow by over 30 percent between 1990 and 2010.

Unfortunately, Kyoto's approach cannot solve the problem.[1] International treaties designed to realize commonly held goals fall into two categories: those that set agreed-upon national objectives but then leave each signatory country to pursue those goals in its own way, and those that define mutually agreed-upon actions. The Kyoto treaty belongs to the first category. The essence of the Kyoto framework is negotiations to allocate national rights to greenhouse gas emissions. Targets low enough to be effective in halting man-made climate change mean that these emission rights will be worth trillions of dollars, even if such rights were traded among countries. Stabilizing the amount of greenhouse gases in the atmosphere will eventually require reducing carbon emissions to levels that cannot be reached without the engagement of the developing countries, but the framework of the proposed treaty is unacceptable to them. There is unlikely to be any generally acceptable principle for allocating valuable emission rights between rich and poor countries, making the success of the Kyoto approach a probable impossibility. We would do better to adopt an alternative strategy that, while difficult, at least has some prospect of bringing man-made climate change under effective control. A successful attack on global warming will only happen through mutually agreed-upon *actions*, such as a nationally collected tax on greenhouse gas emissions, rather than through national emission targets.

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[1] The alleged problem is that large volumes of greenhouse gases—mainly carbon dioxide from burning fossil fuels but also methane generated by rice cultivation and cattle raising—will gradually warm the earth's surface, with countless implications for natural ecosystems as well as for human habitation. There is still serious scientific disagreement on both the magnitude and the timing of such warming. This essay does not enter this debate, but for the sake of argument simply stipulates that there is a problem serious enough for governments to address in the next few decades.

A GLOBAL CHALLENGE

MITIGATING GLOBAL warming through formal collective action will not be easy, for three key reasons. First, climate change from an increased atmospheric concentration of greenhouse gases is a global issue since, whatever their earthly origin, the gases are widely dispersed in the upper atmosphere. Effective restraint must therefore involve all actual and prospective major emitters of greenhouse gases. Today's rich industrialized countries currently account for most of the emissions. The Soviet Union was a major contributor before its collapse in 1991, and an economically resurgent Russia can be expected to follow suit. Moreover, rapidly growing poor countries will soon become major contributors. By 2010 developing countries are expected to contribute 45 percent of total greenhouse gas emissions, and China and India alone will experience greater growth in emissions than all the OECD countries combined. Thus effective action cannot be taken by a small group of countries alone, as was possible with the recent agreement to cease testing of nuclear weapons. Here, while the same requirements need not be imposed on all countries from the beginning, the agreement must be structured from the beginning so that all significant countries will eventually participate.

Second, the rewards from restraints on greenhouse gas emissions will come in the politically distant future, while the costs will be incurred in the political present. Moreover, those rewards are highly uncertain. Much controversy still surrounds the expected impact of

ARCHIVE PHOTOS

Don't do it: Vice President Al Gore and Japanese Prime Minister Ryutaro Hashimoto at the Kyoto summit.

further greenhouse gas emissions on the earth's ecosystems. The residents of some countries, such as Canada and Russia, may even expect to benefit from some surface warming. It will thus be difficult to persuade people that they should make sacrifices in the level or growth of living standards today for the sake of uncertain gains for their grandchildren or great-grandchildren. The wide distribution of expected but distant benefits in response to collective action provides an incentive for every country to encourage all to act but then to shirk itself—the so-called free-rider problem.

Third, the pervasive sources of greenhouse gas emissions—notably burning fossil fuels, cultivating wetlands, and raising cattle—imply that restraint will involve changes in behavior by hundreds of millions if not billions of people, not merely the fiat of 180 or so governments. Thus the most important part of an effective regime to limit climate change involves not an agreement among governments but the effective influence of governments on their publics.

No major legally binding regulatory treaty involves all of these characteristics to a similar degree. Typically, as with the halt to nuclear weapons testing or the Montreal Protocol to limit production of CFCs, the major actors are either governments themselves or a relatively few firms in a relatively few countries. The Convention on International Trade in Endangered Species perhaps comes closest in its comprehensiveness; it requires states to prohibit international trade in the covered products. Various agreements for managing international fisheries require cooperation of thousands of fishermen, but with a few exceptions they have not been notably successful.

The currently preferred approach to a treaty limiting greenhouse gas emissions centers around imposing agreed national targets on emissions—possibly permitting some of the allowed emissions to be sold from one nation to another, a feature that would significantly reduce the costs of a given reduction in emissions. A second approach, which has received less emphasis, stresses agreement on a set of actions that countries would undertake with a view toward reducing emissions. The latter option has been unwisely marginalized. Mutually agreed-on actions have better prospects of success than national targets.

NATIONAL TARGETS

IF TARGETS are to be set, on what basis should they be set? When quantitative targets are imposed within countries, they almost always reflect recent history. Such targets are allocated roughly in proportion to, say, recent emissions of pollutants or recent catch of fish. Targets based on emissions in some past year (e.g., a given country's 1990 emission levels) have a similar character. In effect, they allocate property rights to the existing tenants, conferring ownership on recent users. Targets allocated on this basis will be completely unacceptable, however, to countries that are or expect to be industrializing rapidly. Such nations' demand for fossil fuels grows with disproportionate speed. They will argue that most of the existing greenhouse gases generated by humans were emitted by today's rich countries and that those countries should therefore bear more responsibility for cutting back. Thus, developing countries did not commit themselves to reduce emissions at Rio; in Europe, Portugal and Greece have expressed similar reservations.

At the other extreme, some observers have suggested that simple distributive justice would require that emissions targets be based on population. This would favor heavily populated poor countries such as China, India, Indonesia, Bangladesh, and Nigeria. To be meaningful in limiting climate change, application of this principle would require drastic cutbacks in emissions by today's rich countries, implying radical changes in living conditions there. Targets based on population would, of course, be insensitive to varying resource endowments, which make nations with, say, large capacities for hydro-electric power less reliant on fossil fuels. Such targets would also ignore the fact that countries depend on vastly different fuel mixes as well as different levels of fuel consumption. Reductions in living standards could be mitigated, but not avoided, by the sale of unused emission rights by poor countries to rich ones. But the financial transfers involved would be far more than is likely to be politically tolerable. A typical American family of four could be expected to pay $2,200 a year to sustain its current level of emissions, and total U.S. transfers to the rest of the world could amount to $130 billion a year—over 10 times America's current foreign aid expenditure.[2] Of course, such payments and transfers would diminish insofar as they encouraged reductions in emissions, but significant reductions would take years. Moreover, the transfers would be made to governments, despite the underlying moral rationale for basing targets on the fundamental equality of all individuals. Many governments would object to transferring large sums to repressive regimes such as Iraq or Nigeria.

A combination of historical rights and population-based rights, phasing from one to another, will not solve the problem. Perhaps the most reasonable basis for allocating emission rights and the obligation for reducing emissions would be to calculate a "business-as-usual" trajectory of emissions for each country on the basis of recent history, development prospects, and past experience with the impact of economic development on the evolution of greenhouse gas emissions. Then each country could be charged with reducing emissions by a uniform percentage, chosen in relation to some measure of global reduction requirements, relative to its assigned trajectory. But of course even if this principle was accepted, the debate would simply shift to the choice of trajectories for each country. While impartial scholars might agree on a range of such trajectories, the economic consequences are large enough to make it extremely implausible that the assessments could be negotiated by the interested parties. Developing countries would almost certainly argue for implausibly high growth rates—based not on reality but on their aspirations for development, encouraged by the example of the four Asian tigers in the 1970s and 1980s. To complicate matters further, the principle of reduction by a uniform percentage would also be controversial. Many would no doubt argue for an element of progressivity in the required cuts, whereby rich countries would cut proportionately more rather than accept equally proportioned cuts.

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[2] This calculation values carbon emissions rights at $100 per ton, amounting to a 38 percent levy on oil selling at $20 per barrel. The $100 figure is a rather low one.

IMPLEMENTATION

ONCE NATIONAL targets have been established, they must be translated into conditions that induce firms and households to change their consumption patterns away from activities that emit greenhouse gases. For most economic actors, the only practical way to alter behavior is to create price disincentives—that is, to make the activities that generate the emissions more expensive. An effective treaty to inhibit greenhouse gas emissions needs the cooperation of consuming publics.

In principle, all significant greenhouse gases should be covered, as was agreed to at Kyoto. In practice, however, given the many actors involved and the many sources of emissions, such broad coverage would be impossible to monitor and police. For practical reasons, therefore, the main target is usually fossil fuel consumption, plus a few other high-emission activities like cement production. Monitoring the consumption of fossil fuels is more or less manageable since most of it must pass through some relatively narrow chokepoints like gas pipelines, oil refineries, and electricity generating stations. Most coal production can be monitored at the mine head or on the barges and railroads that transport it.

But this still leaves out a lot of greenhouse gas emissions. Since 1850, only about half of greenhouse gas emissions have come from burning fossil fuels. Other important culprits include burning tropical forests, the use of wood as fuel, livestock and rice cultivation, town dumps, and leakage from gas pipelines. Omitting these sources from a regime based on national targets thus would significantly limit coverage. But such gaps are probably necessary on practical grounds because most changes in emissions from these sources could not be easily monitored. Their omission, on balance, would probably favor the developing countries.

The demanding fossil fuel emissions targets for rich countries could be met by greater efficiency at converting fossil fuels to usable energy in existing plants; switching from coal to natural gas; building new plants and machinery that use less carbon per unit of usable energy, including nuclear power plants; and reducing demand for energy. Unfortunately, the scope for change at the easiest monitoring points is limited. Obsolete generating plants can be replaced with more efficient or less carbon-dependent ones, but demand for such plants in the OECD will be modest over the next 20 years. Replacing power plants faster than obsolescence requires is dauntingly expensive. In developing countries, the demand for electric power is rising rapidly—by an expected 300 percent between 1990 and 2010, as opposed to 20 percent in OECD countries. By 2010, most generating capacity in those countries could in principle use low-carbon-dependent technology.

The consequence is that most of the reduction in the rich countries must come at or near the points of final demand, where the number of consumers is greatest. The reductions must be achieved by some combination of taxation, exhortation, publicity, and environmental education. Many consumers are not aware of the ways they can conserve energy without radical changes in their lifestyles. The key to success is not intergovernmental treaties but incentives that governments provide to their citizens. A treaty merely provides a vehicle for rough "burden-sharing" across countries and some international discipline in pursuit of the targets.

A WISER APPROACH

THERE IS an important alternative to setting national emission targets. That is to agree internationally on a set of *actions* calibrated to achieve the desired reductions in emissions. Since to accomplish their quantitative objectives governments must in any case create incentives for their citizens to alter their behavior, and since we have seen that setting a national allocation of global emission rights is likely to prove so contentious as to be impossible, it may be far easier to agree on a common use of instruments. For problems such as reducing emissions, the favorite instrument of economists is to tax the offending activity. All countries could agree to impose a common carbon emissions tax, which would increase the price of fossil fuels in proportion to their carbon content, with possible tax exemptions for uses that do not emit carbon dioxide, such as production of some plastics.

Such a tax would have at least two major advantages. First, it would encourage reduction of emissions to take place where it could be done at the least cost. All emitters would have the same incentive to reduce emissions, but only those who saved more in tax payments than it cost to reduce emissions would undertake reductions. Others would simply pay the tax. So the tax would encourage natural gas use everywhere (with benefits accruing to Russia and Iran, the countries with the largest known gas reserves). More important, the tax would boost general conservation of fossil fuels.

Second, the tax would generate revenue for governments whose usual sources of revenue hamper economic incentives to work, save, or undertake commercial risks. That should make it attractive to finance ministries everywhere. Where the revenues are large, as they eventually would be, the new tax should be phased in gradually. Growth can be encouraged by reducing other taxes, like those on foreign trade or on earnings. Taxes on fossil fuels would of course have some undesirable effects, such as delaying the switch from firewood to fossil fuels in poor countries. But it would be impractical in most cases to tax firewood.

In principle, it would be possible to extend the idea of a common carbon tax to methane as well, covering wetland rice production, decomposable refuse, gas pipeline losses, and cattle raising. That more difficult step could be phased in later.

Monitoring the imposition of a common carbon tax would be easy. The tax's enforcement would be more difficult to monitor, but all important countries except Cuba and North Korea hold annual consultations with the International Monetary Fund on their macroeconomic policies, including the overall level and composition of their tax revenues. The IMF could provide reports to the monitoring agent of the treaty governing greenhouse gas emissions. Such reports could be supplemented by international inspection both of the major taxpayers, such as electric utilities, and the tax agencies of participating countries.

Instead of the Kyoto approach, impose a tax on fossil fuels.

Imposition of taxes by international agreement raises a major problem for democratic countries, however. Taxation goes to the heart of parliamentary prerogative, and most democracies will not relish taxation by international agreement, even with a requirement for parliamentary ratification. Moreover, as the Clinton administration's 1993 experiment with a BTU-based energy tax illustrates, even modest energy taxes remain politically unpopular. The European Council proposed a somewhat more ambitious tax on energy, but it has yet to be enacted. That proposal paradoxically but not surprisingly gave special preference to coal, which is the most carbon-intensive of the fossil fuels but is produced at high cost in several EU countries, and would also have levied a tax on nuclear power, the least carbon-intensive major source of electricity.

But this political calculus could change dramatically. If we are to act seriously to reduce greenhouse gas emissions, the cost and price of emitting activities is bound to rise. Indeed, a rise in price is necessary to encourage large-scale conservation. It is better that the revenues from the price increase go into the hands of governments that represent the entire public than into unnecessary economic inefficiency or into the hands of large corporations that are allocated emissions quotas.

Furthermore, the imposition of additional taxes does not necessarily imply additional revenues to governments. One possible disposition of revenues from emission taxes would be to reduce other taxes, such as the income tax or the payroll tax. Each country would be free to dispose of the emission tax revenues as it judged best. In the United States, passage of such a tax might be politically easier if coupled with the reduction of other taxes.

Two additional possible problems need to be mentioned, neither insuperable. The first concerns the fact that energy (especially oil) is taxed differentially among countries in the mid-1990s, and some countries continue to price both coal and oil well below world levels. Should a uniform tax be levied on an uneven initial condition? If existing pricing practices are taken to reflect existing national preferences on how best to allocate resources, a case can be made that the new carbon tax should be uniform, not the total tax burden on fuels. Of course, national policies would have to be monitored to ensure that the effect of the new tax was not undermined by other changes in tax or subsidy policy.

A carbon tax could raise $750 billion in annual revenue.

The second possible problem concerns the disposition of revenue. To have a significant impact on emissions, the tax would probably have to be substantial. A substantial tax on a major input to modern economies would generate much revenue. To whom should it accrue? Oil-producing countries will suggest that if oil is to be taxed, they should levy the tax and get the revenue—indeed, that is what OPEC's attempts to control oil prices amount to. Oil-consuming countries, however, would feel doubly aggrieved if they must charge more for oil to discourage its consumption yet do not receive the revenue; they will insist that the tax be levied on consumption and accrue to them, not least so that they may reduce other taxes to assure their continued prosperity and growth. In practice, that view is likely to prevail.

There is, however, a third possible claimant for at least some of the revenue: the international community. The international community has accepted a number of collective obligations that are cumulatively expensive. Caring for refugees and peacekeeping are only the most apparent. Refugees and peacekeeping operations cost the United Nations about $2.6 billion a year, well over the regular annual U.N. budget of $1.2 billion. In addition, donor countries finance about $5 billion a year of U.N.-administered economic assistance to the poorest countries. The Rio convention conditions cooperation by developing countries in reducing emissions on new financial support from the rich countries. These activities could be financed in part by revenues from an internationally agreed tax levied by all countries. Obviously, the major emitters, currently the rich countries, would pay most of the tax. But as poor countries develop, their contribution would increase automatically—an attractive bonus. These collective needs, while substantial, are nonetheless modest in terms of the total revenue likely to be available from an effective carbon tax.

The revenue these taxes would raise is substantial. An OECD model suggests that a worldwide tax on 5.2 billion tons of global carbon emissions in 2020 would yield $750 billion in annual revenue, about 1.3 percent of gross world product in that year. The United States would gather about one-fifth of this amount.

Of course, we do not know how responsive publics may be to any given tax level. The cuts in emissions could be either greater or less than initially projected. Thus a regime based on mutually agreed emissions taxes must allow for subsequent adjustment in tax levels—up or down—as new scientific information on the significance of greenhouse gas emissions for prospective climate change becomes available and as we learn how effective a given level of taxation is in reducing emissions. These effects will become clear only over long periods of time, but that is not a decisive disadvantage when the objective concerns decades and perhaps centuries.

Taxes on greenhouse gas emissions will undoubtedly make energy-intensive products such as steel and cement more expensive. For countries that lack modern infrastructure, these higher prices will raise the costs of building modern housing and transportation systems. On the other hand, tax revenues from emissions would generate badly needed government revenue in such countries and help them avoid levying taxes on other commodities and on incomes, thus removing a frequent drag on development. The net effect is unclear, however, and no doubt will vary from country to country.

DEATH AND TAXES

DEVELOPING COUNTRIES are not likely to constrain their economic growth—and the concomitant demand for energy—for the sake of avoiding global warming. For one thing, adaptation to such climate change as may already be in train will be easier for those countries that are more developed, reinforcing the priority that poorer countries already give to development. Furthermore, developing countries will argue that, apart from local air and water pollution, global environmental degradation is overwhelmingly the fault of the rich countries. They have a point. The relative contributions to environmental degradation can change markedly with successful economic development, but that is a matter that the world's poorer nations are likely to be willing to take into consideration only after industrialization has actually occurred. The bottom line is that many developing countries will cooperate with developed countries in reducing greenhouse gas emissions into the atmosphere only so long as it does not entail great domestic political conflict and so long as the developed countries foot the bill.

For these reasons, the international negotiations for mitigating global warming will be painfully complex. One strategy is for the OECD countries to take on the assignment themselves in the hope that developing countries will join in later after their incomes and fossil fuel consumption have risen considerably. This strategy does not preclude action within developing countries—provided the OECD countries are willing to pay for it. The problem with this strategy is that there seems to be no right time for a country to graduate from "developing" to "developed" status, especially since such a graduation can cost a country its eligibility for development loans and preferential tariffs. Another hitch is that since not all countries will have joined the consensus, stiff OECD action to reduce emissions will lead to a costly relocation of energy-intensive industries to countries that have not yet committed to fight global warming—thus undermining the objective of reducing global greenhouse gas emissions.

An effective treaty cannot be based on the allocation of valuable emission rights since there will be no generally agreed principle for allocation. If the international community is to organize itself at all for the significant mitigation of greenhouse warming, it should be on the basis of mutually agreed actions, such as the imposition of a more-or-less uniform carbon tax on the use of fossil fuels.

International cooperation in other fields has progressed most successfully when there was agreement not only on the objective but also on how best to achieve it. As the prolonged and sometimes acrimonious history leading to international cooperation in containment of contagious diseases suggests, the absence of scientific consensus on how greenhouse gas emissions translate into global warming and how these temperature changes in turn affect the human condition will make it difficult to agree on how to share costly actions or, indeed, on what actions should be taken. Large differences in assessments of the costs of mitigating action will simply magnify the difficulties. But taxes, like death, are inevitable as well as universal, and they can more profitably be imposed on harmful activities than on socially valuable ones. That fundamental truth offers some hope for international action to slow global warming.

Response

Stick with Kyoto

A Sound Start on Global Warming

Stuart Eizenstat

In his critique of the recent Kyoto accord, Richard N. Cooper notes that mitigating climate change will not be easy ("Toward a Real Global Warming Treaty," March/April 1998). He argues that allocating greenhouse gas emissions rights among nations, especially in the developing world, is impractical. Since economists' favorite solution to problems such as emissions is to tax the offending activity, he concludes that a more practical solution would be to have all countries agree on a common carbon emissions tax.

Cooper is right about one thing—fighting global warming will not be easy. Setting differentiated emissions targets among countries with widely diverse histories and national circumstances will be especially difficult. Indeed, Kyoto is one of those ideas that can easily be criticized—until you consider the other options. Cooper's alternative is to create an international obligation to impose energy taxes. But his belief that agreeing on such a tax might be easier than setting emissions targets is out of touch with political reality. Even if it could be arranged, an international obligation to tax emissions could not be expected to work well.

REMEMBER EL NIÑO

Cooper, one of my predecessors in my current position, is skeptical about global warming, referring to it as an "alleged problem." But the matter is serious indeed and requires a concerted international response. Atmospheric concentrations of carbon dioxide, the most important greenhouse gas, are currently about 30 percent above pre-industrial levels. Unless we change course, concentrations in 2100 are predicted to reach levels not seen in more than 50 million years.

The authoritative Intergovernmental Panel on Climate Change (IPCC), com-

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posed of 2,500 scientists worldwide, warns that global warming will harm human health and cause significant loss of life. Potential problems include a rise in the sea level, the spread of infectious diseases, droughts, and floods. For a preview of the type of severe weather in the warmer, wetter world that climate change would bring, look at the devastation wrought by this winter's El Niño. Without policy intervention, the IPCC warns that average global temperatures will increase between 2 and 6.5 degrees Fahrenheit by the end of the next century. By then, average July temperatures in Washington, D.C., will have risen by 5 to 15 degrees, with greater humidity. By comparison, average global temperatures during the last ice age were only about 9 degrees colder than today.

Many, including Cooper, have noted the significant uncertainties associated with global warming, the impact of which will vary from region to region. What is clear, however, is that unless we take action, we will be conducting an unprecedented experiment with our planet. We risk endangering our children and grandchildren. Rational policymakers do not wait until every doubt is resolved before moving. The Kyoto protocol is like an insurance policy: its modest premiums protect against risks that will cost much more to mitigate if the world waits to act.

A GLOBAL TAX WON'T WORK

Cooper's tax proposal is politically impractical and substantively unsound. The United States fought hard and successfully at Kyoto to avoid mandatory measures like an international tax.

To my knowledge, no international agreement has ever imposed an obligation on countries to tax their citizens. This is hardly surprising. An internationally mandated tax would combine two unpopular ideas: paying more of one's money to the government and surrendering part of national sovereignty to an international body. Moreover, energy taxes are anathema in the United States. It would be hard to find a policy that would face greater political hurdles.

Even putting political reality aside for a moment, a common international tax is a bad idea. Countries with existing energy taxes could reduce them while a new international carbon tax was imposed on countries without preexistent energy taxes. The net effect would be little, if any, reduction in emissions. Assuming such behavior is not prohibited by the international regime, the United States, which has relatively low energy taxes, would face a disproportionately large share of the burden. And even if the international system were to prohibit reductions in energy taxes, countries could offset the impact of a new carbon tax indirectly, through other changes in tax or subsidy policies (say, rebates on specific taxes or increases in highway construction financing), while ostensibly maintaining their existing energy taxes. Distinguishing permissible from prohibited policies would be extraordinarily difficult and could bring unacceptable international scrutiny to domestic tax decisions.

Moreover, Cooper fails to see that a system of tradable permits can be as efficient as a tax. If one firm is able to reduce emissions cheaply while another finds it difficult to do so, the first will be able to sell permits to the second, thereby reducing the overall cost of achieving the environmental objective. According to the 1997 Economic Report of the President, the choice between fees and marketable permits is of secondary economic importance. Over 2,500 economists have signed a letter stating, "In order for the world to achieve its climatic objectives at minimum cost, a cooperative approach among nations is required—such as an international emissions trading agreement." That is precisely the logic behind, and the promise of, the Kyoto agreement.

KYOTO'S VIRTUES

Kyoto is still the best basis for action, for three reasons. First, the protocol adopted differentiated targets, recognizing that each country must address climate change based on its own national energy profile and circumstances—a particularly crucial point for developing countries.

Second, Kyoto lets countries pursue their own paths to lower emissions. In one country, that might be an energy tax. In the United States, President Clinton has called for a domestic trading system (to begin by 2008) of the kind that has worked so well, both environmentally and economically, in reducing acid rain.

Third, Kyoto embraces market-based international mechanisms. As noted above, emissions trading is central to achieving Kyoto's goals at modest cost. In addition, the Clean Development Mechanism—which will allow companies in the industrialized world to invest in "clean technology" projects in developing countries and share the credits from reduced emissions—has the potential both to lower costs for U.S. companies and to encourage the transfer of environmentally friendlier technology to developing nations.

Cooper argues that the Kyoto approach cannot work without the participation of developing countries, who will not join in because they will agree neither to an allocation of emission rights nor to constraints on their economic growth. He is half right. Kyoto cannot succeed, either environmentally or politically, unless key developing countries participate. Climate change is a global problem and requires a global solution. Indeed, the president has stated clearly that he will not submit the treaty for ratification without participation by key developing countries. But Cooper is overly pessimistic about the chances that developing countries will join in. Despite the difficulties at Kyoto, several key developing countries did indicate an interest in participating. A comprehensive diplomatic strategy will engage still more.

To be sure, winning over developing nations will not be easy, but Kyoto contains several incentives for them. Efforts to mitigate climate change will help address their more immediate pollution problems. Furthermore, developing countries are the most vulnerable to the dangers of global warming and the least able to protect themselves. Perhaps most important in the short run, the worldwide effort to address global warming can help developing countries economically as well as environmentally. Whenever developing countries take on Kyoto commitments, they will be able to participate in the international emissions trading system, reducing costs and perhaps even generating revenue. Kyoto can help developing nations grow sustainably, without constraints, and by a different energy path than that of countries that industrialized earlier. Sustainable economic growth must be environmentally sound.

Global warming is not a problem we will solve in this decade or this generation. The innovative Kyoto framework should be built on, not discarded.

Kyoto's Unfinished Business

Henry D. Jacoby, Ronald G. Prinn, and Richard Schmalensee

TAKING THE LONG VIEW ON GLOBAL WARMING

EVEN WELL-INFORMED observers disagree about what the Kyoto Protocol on Climate Change will accomplish. Some gaze at its text and see a battle won. They cheer the fact that the generally richer nations participating in the protocol agreed to cut their collective emissions of the greenhouse gases that cause global warming to about five percent less than 1990 levels by early in the next century. These optimists also applaud features of the Kyoto accord designed to hold down the costs of achieving these reductions. In computing their emissions, nations can include changes in the six major greenhouse gases emitted because of human activity, not just carbon dioxide, the most important of the six. In addition, countries can factor in reduced carbon dioxide levels from changes in land use and new forestry techniques that take the gas out of the atmosphere. Groups of participating nations may comply jointly and reallocate commitments among themselves, as the European Union (EU) plans to do within a European "bubble," and there

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is agreement in principle to some form of emissions trading. Joint implementation, under which agents in one country can get credit for reductions they achieve in another, is to be permitted between participating nations, and a new Clean Development Mechanism will provide access to these opportunities in nonparticipating countries, mainly in the developing world. Finally, emissions targets are not rigidly tied to a single year, but to averages over a five-year "commitment period" from 2008 to 2012.

Pessimists, on the other hand, see Kyoto as a costly defeat. They note that there is no solid proof that human-induced climate change will occur or that its adverse effects would be serious were it to happen. At the same time, the expense of reducing greenhouse gas emissions to meet the Kyoto targets will be substantial, and pessimists believe that the effort will make participating countries less competitive. In the darkest interpretation, the Kyoto agreement is a pact among rich nations that will cripple their economies for decades to come, made simply because today's political leaders needed to burnish their environmental credentials.

Neither of these schools of thought is correct. Still a third group, whose views are much closer to the mark, believes that Kyoto mainly postpones much-needed work on what may prove a very serious long-term challenge. To them, Kyoto is a quick political fix for a problem created at the First Conference of Parties to the Climate Convention held in Berlin in 1995. The so-called Berlin mandate instructed negotiators to seek short-term, legally binding targets and timetables for emission control for participating countries only. In the run-up to Kyoto, many leaders publicly committed themselves to this idea. Not surprisingly, avoiding embarrassment on this score became the dominant focus of the negotiations. As a result, this group argues, the Kyoto agreement allows political leaders to declare success, but it does not address the larger climate issues at stake.

Even worse, these skeptics fear that by following the Berlin mandate, negotiators at Kyoto may have made it harder, not easier, to meet the long-term challenge. Now the next decade may be spent haggling over these short-term commitments, thereby diverting attention from more important century-scale issues and postponing the involvement of the developing world. The Kyoto agreement might fail to meet even its immediate goals if the lack of domestic support in the United States prevents ratification, which in turn would rationalize inaction by other participating nations. The entire international response to climate change could be discredited, thus increasing the difficulty of collective action in the future, no matter how serious the problem turns out to be.

To some degree, these widely divergent analyses of the Kyoto achievement reflect differing interpretations of its text, key parts of which are still the subject of strong and sometimes bitter international disagreement. Some of these points will be taken up again at the Fourth Conference of the Parties in November, but others may take years to resolve. What is in dispute is not merely the Kyoto text, of course, but the underlying science and economics of global warming. Above all, for the journey from Kyoto to succeed, policymakers will need to spend more time thinking of the long term.

A GLOBAL WARMING PRIMER

To START with the basics, climate change can be driven by an imbalance between the energy the earth receives from the sun, largely as visible light, and the energy it radiates back to space as invisible infrared light. The "greenhouse effect" is caused by the presence in the air of gases and clouds that absorb some of the infrared light flowing upward and radiate it back downward. The warming influence of this re-radiated energy is opposed by substances at the surface and in the atmosphere that reflect sunlight directly back into space. These include snow and desert sand, as well as clouds and aerosols. (Aerosols are tiny, submicroscopic solid or liquid particles suspended in the air, such as smoke and fog.)

Water vapor and clouds, which typically remain in the atmosphere for a week or so, are responsible for most of the re-radiated infrared light. Central to the climate change debate, however, are less important but much longer-lasting greenhouse gases, most notably carbon dioxide. Atmospheric concentrations of carbon dioxide and other long-lived greenhouse gases have increased substantially over the past century. As this has happened, the flow of infrared energy to space has been reduced, so that, all else being equal, the earth receives slightly more energy than it radiates to space. This imbalance tends to raise temperatures at the earth's surface. These aspects of the greenhouse effect are not controversial. It is also generally accepted that emissions of carbon dioxide from the combustion of fossil fuels (primarily coal, oil, and natural gas) are the most significant way humans can increase the greenhouse effect, and that this emitted carbon dioxide remains in the atmosphere for a long time, on the order of a century or so.

What is much more uncertain, and the cause of serious scientific debate, is the response of the complex system that determines our climate to changes in the concentrations of greenhouse gases in the atmosphere. Some poorly understood processes in the climate system tend to amplify the warming effect of greenhouse gases, while others, equally poorly understood, tend to counteract or dampen it. Any global warming will likely be delayed because it takes a lot of heat to warm the oceans, but it is not known just how rapidly heat is carried into the ocean depths.

To predict climate, scientists must use mathematical models whose complexity taxes the capabilities of even the world's largest computers. These models are based on incomplete knowledge about the key factors that influence climate, including clouds, ocean circulation, the natural cycles of greenhouse gases, natural aerosols like those produced by volcanic gases, and man-made aerosols like smog. Today's climate models cannot reproduce the succession of ice ages and warm periods over the last 250,000 years, let alone the smaller climatic fluctuations observed over the last century. In addition, climate models are driven by forecasts of greenhouse gas emissions, which in turn rest on highly uncertain long-term predictions of population trends, economic growth, and technological advances.

BURNING DOWN THE HOUSE?

To HELP quantify the uncertainty in climate prediction, we and our MIT colleagues have developed a model of global economic development, climate processes, and ecosystems. We have produced seven forecasts of climate change over the next century, each of which assumes no action to restrict future greenhouse gas emissions and can be defended as possible given current knowledge. These forecasts involve changes in global average surface temperature between 1990 and 2100 as small as two degrees Fahrenheit or as large as nine degrees Fahrenheit (roughly one to five degrees centigrade). We cannot sort out which of these paths (or other possible ones) we are heading along, although we are less likely to be on one of the extreme ones. There may be other paths involving rapid climate changes driven by purely natural processes that are not well handled by any current climate models.

Unfortunately, we know even less about the likely impact of climate change. Warming may increase storm damage, for instance, but it may also decrease it. Very little is known about the likely impact on human health or the ability of unmanaged ecosystems to adapt to shifting conditions. Civilization and natural systems have coped with climate change in the past and can, to at least some degree, adapt. What we do know suggests that the changes summarized by the lowest of the seven forecasts would do little harm and might even benefit some countries. Most analysts would agree, however, that the highest of our seven forecasts implies significant risks to a variety of important natural processes including ocean circulation, polar glaciers, and unmanaged ecosystems, as well as agriculture and other human activities. Indeed, for policymakers, the most important finding of climate research to date may be that the range of possible outcomes is so wide. Sound policy decisions must take account of this profound uncertainty, and it is plainly vital to accelerate research aimed at reducing it.

If you smell smoke at home, it would be silly to do nothing until you actually see flames…

An important complement to the work on forecasts is the search for what has been called a fingerprint—evidence that would clearly reveal human influence on climate. In its 1995 report, the Intergovernmental Panel on Climate Change (IPCC) declared in its *Summary for Policymakers* that "the balance of evidence suggests a discernible human influence on climate." Several scientists, however, subsequently questioned the scientific basis of this summary and the certainty it conveyed. Hence the hunt for definitive evidence of human-induced climate change remains an important research area—mainly because the stronger the human influence on climate, the earlier it will be possible to detect its "signal" despite the "noise" of natural variability in climate over time. The larger the proven human influence on climate, the stronger will be the case for substantial reductions in greenhouse gas emissions.

The current debate about detection does not justify inaction. As our range of forecasts indicates, we know enough to conclude that human activity may produce significant global warming, with substantial adverse impacts. It would be irresponsible to ignore such a risk, just as it would be irresponsible to do nothing when you smell smoke at home until and unless you see flames. It would also be irresponsible, of course, to call the fire department and hose down all your belongings at the slightest whiff of what might be smoke.

WHAT IT TAKES

THE ULTIMATE goal of the climate treaty to which the Kyoto protocol is attached is stabilizing atmospheric concentrations of greenhouse gases at levels that will avoid "danger" to economies and ecosystems. No one knows what the appropriate levels might be, or even if the implicit notion of a sharp line between danger and safety makes sense. The nature of the potential task can be explored, however, by studying an EU recommendation that countries stabilize the amount of carbon dioxide in the atmosphere at roughly twice preindustrial levels, in the long run. Doing this would slow climate change but, according to most climate models, not stop it. For the middle range of MIT model forecasts, following the IPCC path to stabilization at the EU target would lower projected warming between now and 2100 by only about 30 percent, although it would produce a larger percentage reduction in the following century.

Following this EU recommendation would require very sharp cuts in global carbon dioxide emissions, however, and the current signatories to the Kyoto protocol could not do the job by themselves. If the nonparticipating nations were to accept no restrictions, net emissions by participating nations would somehow have to become negative by around the middle of the next century. Even a total ban on use of fossil fuels by all industrialized countries would not reach the target.

Of course, if the nations currently participating in Kyoto reduce their emissions, other nations might also eventually agree to lower theirs. Unfortunately, income growth in the most populous nonparticipating countries—including China, India, Indonesia, and Brazil—seems unlikely to encourage voluntary efforts until the latter part of the next century. Until then, these nations will naturally be more concerned with feeding their children than with protecting their grandchildren from potential global warming. Thus, if the relatively rich participating countries want to stabilize atmospheric concentrations of greenhouse gases, they will have to pay at least some poor countries to reduce their emissions. Achievement of substantial reduction in this way implies international transfers of wealth on a scale well beyond anything in recorded history.

...but you also should not hose down the house after one whiff of what might be smoke.

There is no effective political support for such a herculean effort, particularly in the United States. Given the uncertainties discussed above, such an effort would make little economic sense in any event. The groundwork, however, must be laid now to preserve any hope of someday mounting such a response. Future generations will find three legacies especially valuable: participation of all countries in climate-related actions, development of new technologies to lower the cost of emissions control, and the creation of institutions for cost-effective multinational action.

First, a substantial reduction in global emissions will require something close to worldwide participation, so it is essential to build a climate agreement that can encompass countries not currently participating in Kyoto—including most of the developing world. Such an accord must include a way for these countries to gradually accept the burdens of emissions control. Equally important, it must also anticipate a regime to govern climate-related transfers of resources to countries that cannot bear the cost of emissions reduction.

An exclusive emphasis on the relatively wealthy nations participating in Kyoto is a double-edged sword. If rich nations do not control their emissions, poorer ones are unlikely even to consider slowing theirs. But carbon dioxide emission controls will raise the cost in participating countries of manufacturing those goods whose production requires substantial energy. For these products, industries in developing countries will gain an advantage over industries in countries that abide by Kyoto. Once they have invested in production facilities, nonparticipating nations will be more reluctant to take emission-control measures that threaten these activities.

If rich nations do not control their emissions, poor ones will not even consider slowing theirs.

Second, it will be nearly impossible to slow warming appreciably without condemning much of the world to poverty unless energy sources that emit little or no carbon dioxide become competitive with conventional fossil fuels. Only a large R&D effort can have any hope of bringing this about, although it would be cheap relative to the cost of dramatic reductions in carbon dioxide emissions using current technologies. The range of technological options is wide—from using solar power to produce electricity to converting fossil fuels to hydrogen fuel and storing (underground or deep in the ocean) the carbon dioxide produced as a byproduct. Few of the alternatives currently under discussion, however, can be widely used at reasonable costs without fundamental improvements.

Finally, since climate change will be a high-stakes global issue for many decades, the world must begin to develop international institutions that will facilitate policies that minimize the cost of reducing greenhouse gas emissions. For starters, this requires solving the monitoring and enforcement problems necessary to implement efficient international trading of rights to emit greenhouse gases (or to implement internationally harmonized taxes on greenhouse gas emissions). It also requires an institutional structure that can exploit the cheapest abatement opportunities, wherever they may be found, and a decision-making process that can adjust policies to reflect changes in scientific knowledge and economic development.

This is a tall order. The international trade regime developed under the General Agreement on Tariffs and Trade, now the World Trade Organization, hints at the difficulties involved. This regime grew and evolved over time, adding countries and goods along the way, peacefully resolving conflicts between national economic interests, and contributing importantly to global economic growth. By the standards of international affairs, the WTO has been a stunning success, but it took 50 years of hard work—even given an intelligent, forward-looking design at the outset.

A KYOTO REPORT CARD

KYOTO'S RESULTS are mixed. The agreement failed miserably at including poorer countries. Until the last minute, the negotiating text at Kyoto contained a provision allowing a nonparticipating nation to choose, at any time and on a voluntary basis, a level of emissions control it felt was appropriate to its circumstances. This "opt-in" provision made sense as an opening to wider participation, particularly since some nonparticipating nations, like Singapore, are wealthier than some participants, like Romania. Several nonparticipating countries supported the idea, but the provision was struck from the protocol because key developing countries—especially China and India—strongly opposed adding any avenues that could lead to emissions limits for them. For their part, the developed countries were unwilling to risk deadlock on this issue and let Beijing and New Delhi have their way.

Investment in research and development on new long-term technical options was not even discussed. One phrase calling for parties to "cooperate in scientific and technical research" was tucked away in the text, but that was all; no nation was obliged to devote any resources to R&D. Politicians love to call for more research instead of more regulation, but there is little commitment to the long-term development of greenhouse-friendly technology by those countries most capable of producing it.

The news from Kyoto is more encouraging regarding provisions to facilitate flexible, cost-efficient policies for controlling emissions. Including multiple gases was a step in the right direction. In principle, schemes like the Clean Development Mechanism may encourage making emissions reductions wherever they are least expensive. But these systems give credit for specific emissions reductions, and U.S. experience with similar policies indicates that the administrative and transaction costs of the required project-by-project approval process are likely to limit their benefits substantially. Most important, the Kyoto provision that in principle allows the trading of rights to emit greenhouse gases, if implemented effectively, would yield major reductions in cost.

Other features built into Kyoto to create more flexibility give less cause for celebration. The provision for multicountry "bubbles," within which national emissions limits can be adjusted as long as the total is kept constant, is an artifact of short-term political convenience. The creation of such a bubble for the EU is entirely consistent with other EU institutions. It provides a mechanism for differentiation within the EU while its leaders seek uniform commitments from non-Europeans. The application of the idea to other groups of nations emerged as Washington's defensive response to widespread and continuing opposition to emissions trading. If full-fledged trading were ultimately lost, at least some flexibility might be gained in the short term through government-to-government shifting of quotas. While such arrangements may reduce costs over the next few years, they will not provide flexibility in the long run, and they might make it harder to realize the benefits of full global trading by balkanizing the market.

Kyoto failed miserably at including poorer countries in the effort against climate change.

The inclusion in the Kyoto protocol of credits for "carbon sinks"—increases in the removal of carbon dioxide from the atmosphere because of post-1990 changes in land use and forestry practices—is another double-edged sword. In principle, measures to encourage the use of these sinks should be covered by Kyoto because they may be cost-effective for some countries. Land vegetation is already removing carbon from the atmosphere, on balance, probably spurred by increased plant growth caused by rising atmospheric carbon dioxide. The uncertainties are great, but central estimates in the IPCC report indicate that for the world as a whole, the net removal of carbon dioxide from the atmosphere in this way amounts to about 30 percent of current emissions from the burning of fossil fuels. For countries with large forests, such as the United States, Canada, and Russia, biological sinks may play an important role in their emissions accounting. With stakes this large, and with ambiguity inherent in the protocol's definitions of the 1990 baseline and of increases in removal by sinks, fierce debates about measurement and accounting are already under way. The sinks issue could easily become a troubling diversion.

Finally, it is important to be clear-eyed about the risks involved in the core agreement of the Kyoto protocol: national targets and the 2008-12 timetable. On the positive side, the Kyoto targets are a start toward a long-term solution. If participating countries meet the 5 percent reduction goal and stabilize their emissions at that level for the rest of the century, then—with no restrictions on nonparticipating nations—warming by 2100 will be reduced by about 16 percent. Also, these initial cuts could have important symbolic value, providing incentives for R&D and laying the groundwork for broader national participation. The risk is that these advantages will be lost, and worse, if the emissions reductions agreed to in Kyoto are not met—as they probably will not be. The longer any nation delays adopting serious controls on greenhouse gas emissions, the higher the cost of meeting its Kyoto obligations and the more difficult it will be to generate the requisite domestic political support. The current U.S. policy involves a long delay, which is likely to discourage earlier action by other participating nations fearing a loss of international competitiveness.

The current U.S. climate plan has two main provisions. First, the Clinton administration has asked Congress for $6.3 billion over five years for a technology initiative offering tax incentives and R&D expenditures "to encourage energy efficiency and the use of cleaner energy sources." Second, after a "decade of experience, a decade of data, a decade of technological innovation," the plan holds that whatever administration is in office in 2007 will cap U.S. greenhouse gas emissions and institute a domestic system of tradable rights to emit. Unfortunately, under current policy, the end of the "decade of opportunity" is likely to find U.S. emissions 20 to 25 percent above the 1990 level. The International Energy Agency estimates that by 2000 the United States' emissions will be 16 percent higher than they were in 1990, and climbing. It is simply laughable to forecast that Washington would then impose a cap on emissions stringent enough to turn the energy economy around in three to five years. Moreover, the administration has promised not to send the Kyoto protocol to the Senate for ratification until developing nations commit to "substantial participation." It is not easy to see when such a condition might be met, particularly if vigorous U.S. action is in any way needed to involve the developing world.

Thus, Kyoto is likely to yield far less than the targeted emissions reduction. That failure will most likely be papered over with creative accounting, shifting definitions of carbon sinks, and so on. If this happens, the credibility of the international process for addressing climate change will be at risk. Other outcomes are possible, of course.

Other nations may decide to move forward with emissions control despite U.S. inaction. Changes in U.S. public opinion may accelerate domestic action. Small investments in research may yield unexpectedly large near-term payoffs. Slow economic growth may hold emissions down. Still, even meeting the aggregate Kyoto target will be a hollow victory if it requires spending economic resources and political capital that would be better used to prepare for the vastly greater reductions in global emissions that may be required in the future.

NOW, THE HARD PART

EVEN THOUGH the dust has not settled from the struggle in Kyoto, preparations have begun for the Fourth Conference of the Parties (COP-4) in November. Its focus should be on the longer term.

It is most important to try again to develop a system that can include developing countries and, if necessary, transfer substantial resources to help them participate in a global effort to control emissions. Two opportunities are apparent, one recently rejected at Kyoto and the other only recently advanced there. First is an amendment to Kyoto that restores the provision that would allow nonparticipating countries to volunteer to control their emissions under flexible terms. For any nation seriously concerned with climate change, this should be a necessary condition for ratification of the Kyoto protocol. If the developing countries' opposition to even voluntary action cannot be overcome, it is probably better to scrap Kyoto and start negotiations again when opinions have changed.

Given success on this point, there may then be room for progress on negotiating the details of the Clean Development Mechanism. The protocol suggests that the "operating entities" that will decide how much credit will be given for specific emission reduction projects under the CDM might serve as intermediaries, helping to reduce transaction costs. If so, the CDM might help bring developing countries into the fold. Most studies find that emissions can be least expensively reduced in those countries, so that nonparticipating nations could, in principle, make a great deal of money selling emissions reductions to participating nations. On the other hand, the U.S. regulatory experience suggests that because it is hard to estimate precisely what emissions would have been in the absence of particular investments, the CDM could also produce red tape and plenty of administrative jobs but have scant impact on emissions. Much depends on the details to be worked out in COP-4. If those negotiations produce a heavily bureaucratic structure, perhaps burdened with taxes on trades in emissions reduction credits, it may be better to reject this proposal and begin anew.

Dealing seriously with climate change requires a substantial R&D program to produce new technologies that could bring about deep global emissions reductions and still allow robust economic growth. Such an effort should involve several wealthy participating nations. Candidate technologies include nuclear, solar, hydroelectric, geothermal, and hydrogen from fossil fuel. Methods for safe and economical long-term storage of carbon in subterranean reservoirs, the deep ocean, and forests are also important research areas, as are technologies that enhance energy efficiency. In contrast, the U.S. "technology initiative" concentrates on subsidizing the adoption of existing technologies but would spend little in the search for long-term breakthroughs. Efforts elsewhere are similarly dwarfed by the challenge.

Finally, a well-designed, durable institutional structure can significantly reduce the cost of limits on global emissions. Here, the key piece of unfinished business from Kyoto is implementing a system for trading the rights to emit greenhouse gases among participating nations. In negotiating the details of this system, now scheduled for COP-4, a focus on clear definitions, vigilant monitoring, and strict enforcement is essential. Otherwise, the market should be left unfettered. Many nations oppose trading in any form; others want to restrict its use in meeting emissions commitments. If they make it impossible to implement a plausible framework for international trading of emission rights, the Kyoto protocol is headed for a dead end, obviating the point of ratifying it.

The challenge will be developing a framework for international decision-making that can work for several decades. Building these three legacies—inclusion of the developing world, R&D, and flexible provisions for emissions reductions—will be a huge undertaking. But since no serious response to climate change is possible without them, the task merits the same sense of urgency that motivated Kyoto. When it comes to climate change, the world's work has just begun.

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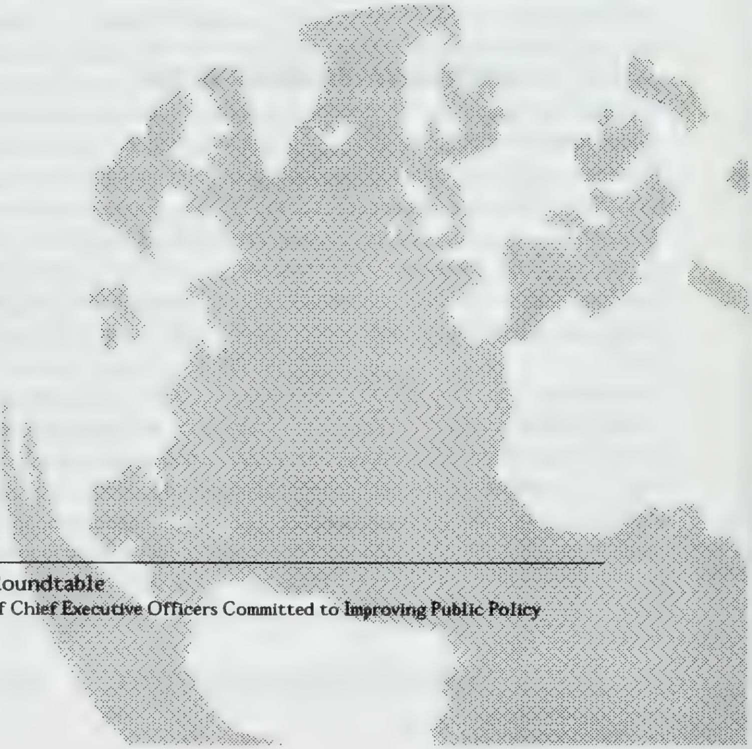
A Gap Analysis

June 1998



The Business Roundtable
An Association of Chief Executive Officers Committed to Improving Public Policy

Environment Task Force

The Kyoto Protocol

A Gap Analysis

A White Paper from THE BUSINESS ROUNDTABLE
June 1998

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EXECUTIVE SUMMARY

In an in-depth analysis of an international agreement to curb greenhouse gas emissions, The Business Roundtable finds that the accord, known as the Kyoto Protocol, contains major gaps that must be filled before its impact on the world's environment and economy can be evaluated. The Business Roundtable recognizes that the Protocol is only a first step toward a comprehensive agreement to reduce emissions, but urges the Clinton Administration not to sign the Kyoto Protocol until these gaps have been addressed.

Background

On December 11, 1997, in Kyoto, Japan, the Parties to the United Nations Framework Convention on Climate Change reached an agreement, known as the Kyoto Protocol, that sets legally binding limits on the man-made emissions of greenhouse gases from 38 industrialized countries. Global carbon emissions would continue to increase under the agreement because it exempts Developing Countries—including China, India, Mexico, Brazil, and 130 others—from any commitments to limit their rapidly growing emissions. Continued growth in energy demand, and thus greenhouse gas emissions, by Developing Countries will more than offset the reductions made by Developed Countries. President Clinton is expected to sign the Kyoto Protocol later this year, but he does not intend to submit the agreement to the Senate for its constitutional role of advice and consent until "key" Developing Countries agree to "participate meaningfully" in the effort.

Key Issues of Concern

- **The targets and timetables would require the U.S. to make significant and immediate cuts in energy use.** The Protocol would require the U.S. to reduce emissions 7% below 1990 levels by 2008-2012, an unprecedented 41% reduction in projected emission levels. The process of Senate ratification and the subsequent lengthy domestic implementation process post-ratification would leave the U.S. very little time to make the painful choices regarding energy use that will be necessary to achieve these reductions. In addition, because the Protocol sets different targets for each industrialized country and the target is based on what is now an eight-year-old baseline, the U.S. in effect will shoulder a disproportionate level of reduction and may be placed at a competitive disadvantage.

- **Unless the Developing Countries also commit to emission reductions, the Protocol is incomplete and will not work.** The Byrd-Hagel Resolution, unanimously adopted by the U.S. Senate in July 1997, states that the U.S. should not be a signatory to any protocol unless it mandates "new specific scheduled commitments to limit or reduce greenhouse gas emissions for the Developing Country Parties within the same compliance period." Many Developing Countries are rapidly growing their economies and will become the largest emitters of greenhouse gases in the next 15-20 years. *Greenhouse gases know no boundaries, and stabilization of greenhouse gas concentrations cannot be achieved without global participation in a limitation-reduction effort.* Moreover, regulating the emissions of only a handful of countries could lead to the migration of energy-intensive production—such as the chemicals, steel, petroleum refining, aluminum and mining industries—from the industrialized countries to the growing Developing Countries.
- **Certain carbon "sinks" may be used to offset emission reductions, but the Protocol does not establish how sinks will be calculated.** Carbon sinks, a natural system that absorbs carbon dioxide, have tremendous potential as a means of reducing emissions, but too much is currently unknown to make a fair determination. *It is unclear how sinks might help the U.S. reach its emission-reduction commitment.* It is understood that the rules for sinks will be addressed at the Fourth Conference of the Parties (COP4) in Buenos Aires, but until they are fully fleshed out their potential impact cannot be evaluated.
- **The Protocol contains no mechanisms for compliance and enforcement.** Simply put, it would be inappropriate for any country to ratify a legally binding international agreement that lacks compliance guidelines and enforcement mechanisms. The Protocol outlines a system of domestic monitoring with oversight by international review teams, but what constitutes compliance and who judges it will not be determined until after the

Protocol enters into force. *The means of enforcement—also unknown—is equally critical, since a country's noncompliance could give it a competitive advantage over the U.S. and eviscerate the agreement's environmental goals.*

- **The Protocol includes flexible, market-based mechanisms to achieve emission reductions, but it does not establish how these mechanisms would work and to what extent they could be used.** The U.S. intends to rely heavily on market-based mechanisms to find the most efficient and cost-effective ways to reduce emissions. But until the rules and regulations are established it is uncertain how effective these mechanisms will be and to what extent they can be used by companies. Many countries are resisting these market-based mechanisms and their reluctance may hinder the development of adequate free-market guidelines. *The absence of many countries from the marketplace, and the possible limitations and restrictions on the marketplace, could render these mechanisms useless or of little value.*
- **The Protocol leaves the door open for the imposition of mandatory policies and measures to meet commitments.** Just as the U.S. favors flexible market mechanisms, the European Union and many Developing Countries favor harmonized, mandatory "command-and-control" policies and measures—such as carbon taxes and CAFÉ standards—to meet commitments, and they will have numerous opportunities to seek adoption of these policies.
- **Finally, the procedures for ratification of, and amendment to, the Kyoto Protocol make it difficult to remedy before it enters into force.** The Protocol may not be amended, nor can rules and guidelines be adopted, until after the Protocol enters into force. The Clinton Administration is now considering the negotiation of a separate or supplemental protocol to attain necessary additional commitments, but this approach would open all issues to further negotiation.

The Business Roundtable believes that the Congress and the American people cannot evaluate the Kyoto Protocol until the Administration sets out a plan as to how it intends to meet the targets of the Protocol. To place the magnitude of the U.S. reduction commitments in perspective, it is the equivalent of having to eliminate all current emissions from either the U.S. transportation sector, or the utilities sector (residential and commercial sources), or industry. The Administration needs to detail how targets in the Protocol will be met, and how the burden will be distributed among the various sectors of the economy.

The Business Roundtable feels it is imperative that a public dialogue take place on the major issues highlighted in our Gap Analysis before the Protocol becomes the law of the land and government agencies begin to write regulations.

I. INTRODUCTION

On December 11, 1997, in Kyoto, Japan, the Parties to the United Nations Framework Convention on Climate Change (the "Framework Convention" or "FCCC") reached an historic and unprecedented agreement to impose legally binding limitations on man-made greenhouse gas emissions of industrialized countries listed in Annex I to the Framework Convention (the "Developed Countries").[1] The "Kyoto Protocol" sets differentiated targets for Developed Countries to reduce or limit their emissions; the United States must reduce its emissions 7% below 1990 levels by the years 2008-2012.[2] The Protocol does not mandate specific policies or measures to achieve these reductions, and establishes, in concept, market mechanisms which may help Parties find more efficient ways to reduce emissions.

The Kyoto Protocol builds on commitments made by one hundred and sixty-seven countries under the Framework Convention in 1992 for Developed Countries to voluntarily return their greenhouse gas emissions to 1990 levels by the year 2000. In 1995, the Parties determined that voluntary aims would be insufficient and that post-2000 objectives needed to be established by the Parties. Through the "Berlin Mandate," the Parties committed to negotiate a new agreement that would include legally binding emission reduction measures for Developed Countries. The Berlin Mandate specifically excluded the Developing Countries—including China, India, Brazil, Mexico and one hundred and thirty other nations—from any new obligations to curb their emissions.

The Kyoto Protocol is open for signature at the United Nations headquarters in New York until March 15, 1999. Thereafter, Parties to the Framework Convention can still join the Protocol by accession.[3] The Protocol will enter into force on the ninetieth day after: (a) not less than fifty-five Parties have joined the Protocol; and (b) a sufficient number of Developed Countries have joined the Protocol to account for at least 55% of all carbon dioxide (CO_2) emissions by Annex I Parties in 1990.[4] The Clinton Administration has announced that the President will sign the Protocol within the one-year period at the "time that makes the most sense in terms of the overall diplomatic situation," but that he will not submit the agreement to the United

States Senate for its constitutional role of advice and consent until there is "meaningful participation" by "key" Developing Countries.[5] According to Undersecretary of State Stuart Eizenstat, the senior U.S. negotiator for the Kyoto Protocol, obtaining such commitments from Developing Countries could take months or years.[6]

The act of signing the Protocol alone does not bind a Party to the Protocol, but it does evidence an intention of the Party to seek ratification and act in a manner consistent with its commitments. As such, it is critical to understand that the Kyoto Protocol is a final agreement that may only be amended by the Parties to the Protocol after it enters into force through the procedures established in the agreement. The rules and guidelines necessary for implementation of the Protocol also must be adopted after the Protocol enters into force. Given these constraints, Administration officials now suggest that they may negotiate a "supplementary" protocol or other agreement for Developing Country commitments. The Conference of the Parties may seek to negotiate a separate agreement to attain additional commitments at any time, but this process also provides other Parties with the opportunity to revisit their favored policies as well.

The purpose of this paper is to examine the Kyoto Protocol—what the agreement would require the United States and other Parties to do and what "gaps" exist in the agreement. The current gaps in the Kyoto Protocol make it difficult to analyze and nearly impossible to assess its impact on the United States. Until these gaps have been addressed, the Clinton Administration should not consider signing the Kyoto Protocol, an incomplete agreement that, the Administration admits, is not ready for ratification.[7] It is only after the gaps have been filled that the Kyoto Protocol or any future agreement can truly be judged as to whether it effectively serves to mitigate climate change and does not cause economic harm to the United States.

II. TARGETS AND TIMETABLES FOR GREENHOUSE GAS EMISSION REDUCTION COMMITMENTS

Article 3 of the Kyoto Protocol: Requires Developed Countries to "individually or jointly" ensure that their aggregate man-made emissions of six greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC_5), perfluorocarbons (PFC_5), and sulfur hexafluoride (SF_6)—do not exceed their assigned amounts during the five-year commitment period from 2008-2012. This translates into an overall reduction of 5.2% below 1990 emissions levels.

Annex B of the Kyoto Protocol: Establishes differentiated quantified emission limitation and reduction commitments for Developed Countries, based on 1990 emission levels for CO_2, CH_4, and N_2O, and 1995 (or, if desired, 1990) levels for HFC_5, PFC_5, and SF_6.

- The United States must reduce its emissions 7% below 1990 levels;
- Some of the other Developed Countries' commitments are as follows: European Union (-8%), Japan (-6%), Canada (-6%), Russia (0%), and Australia (+8%);
- Developing Countries have no emission limitation or reduction commitments.

The Kyoto Protocol mandates an unprecedented 41% reduction of greenhouse gas emissions by 2008-2012 for the United States from the business-as-usual path. In 1996, the U.S. was already 9% above 1990 levels and, according to the U.S. Energy Information Administration, the United States is projected to be 34% above 1990 levels in the year 2010.[8] Thus, what may superficially seem to be a modest 7% reduction below 1990 levels becomes, in real terms, a legal obligation for the U.S. to cut 560 million metric tons (mmts.) of carbon dioxide alone per year by 2008-2012.[9] (The U.S.'s annual CO_2 emissions in 2010 are projected to be 1803 mmts without further mitigation efforts.) Since no further reductions have been discussed, most assessments have assumed sustained emissions at that reduced level.

Can this reduction level realistically be met? The Administration's 1997 Climate Action Report asserts that: "… even the most draconian measures would likely be insufficient to reverse the growth of greenhouse gases and return emissions to 1990 levels by the year 2000…". The 1997 Report projects that the current climate mitigation programs will reduce emissions only 169 mmts, just 26% of the total U.S. reduction commitment. The Administration also suggests that electricity restructuring and additional voluntary private sector initiatives may reduce emissions further, though these proposals are not sufficiently advanced to make a determination. Beyond that, the Administration has suggested that it intends to rely primarily on the proposed flexible mechanisms in the Protocol (i.e., emissions trading, joint implementation, and the Clean Development Mechanism), though these mechanisms remain undeveloped and untested, and on the thus far unquantifiable sinks.[10] Continued economic growth also could complicate reduction efforts: one of the major reasons that the U.S. will not meet its voluntary aim to return emissions to 1990 levels by the year 2000 is because of the unexpected growth in the U.S. economy over the last several years.[11]

To even approach the U.S. reduction commitment will require more than just government incentives and limited market mechanisms; it will require difficult choices. To place the magnitude of the U.S. commitments in perspective, it is the equivalent of having to eliminate *all* current emissions from either the U.S. transportation sector, or the utilities sector (residential and commercial sources), or industry.

U.S. Carbon Emissions

(in million metric tons)

U.S. Sector	1995 emissions levels	2010 projected emissions levels	Kyoto Protocol mandate (2008-2012)
Residential	269	338	
Commercial	218	274	
Industrial	464	563	
Transportation	481	628	
Total	1432	1803	1243

The total gap between what is required and projected emissions = 560

Source: Energy Information Administration Annual Energy Outlook 1998, November 7, 1997.

On an individual basis, every U.S. citizen would have to reduce emissions by 2.5 metric tons per year by 2010. It is difficult to conceive of such drastic short-term reductions being consistent with sustained economic growth and a growing population.

The Protocol's initial commitment period, 2008-2012, will give the United States, and U.S. companies, little time to achieve the necessary reductions. From now until the year 2012 may seem like a long period of time for the United States to chart a course of emission reductions. However, the Administration has indicated that it may be several years before it could submit the Protocol (or another future agreement) to the Senate for ratification. Thereafter, in fulfillment of its constitutional role, the Senate must give its consent to the President, by a two-thirds majority vote, to ratify the Protocol.[12] After that, if the Protocol is ratified, the Administration will need to formulate a proposal to implement the Protocol and submit legislation to the Congress for its consideration. The subsequent legislative process could take several additional years post-ratification, followed by a state implementation process as well. Even then, mechanisms designed to increase flexibility and reduce compliance costs like international emissions trading may not be available if the Parties to the Protocol have not agreed on the rules and guidelines. In any event, emission trading will not likely be available domestically until 2008, when the first commitment period commences.[13]

Even minimizing the importance of meeting the requirements of Article 3(2) of the Kyoto Protocol, which requires "demonstrable progress" by Developed Countries in meeting their commitments by 2005, the United States will likely need to ratify the Protocol and begin implementation well before the commencement of the first budget period in the year 2008 to have any realistic chance of meeting its commitments. As the following chart makes clear, the initial commitment period is unrealistic given the constitutional obligations for ratification and the subsequent lengthy domestic implementation process.

Necessary Steps That Must be Taken Before Implementation of the Kyoto Protocol

- Negotiations leading to the inclusion of Developing Countries in same or supplementary Protocol
- Rules and guidelines for emissions trading among Annex I countries (and other major unresolved issues)
- Submission of Protocol to U.S. Senate for its advice and consent
- Ratification by President and filing with United Nations
- Formulation of domestic climate action plan by Administration
- Congressional consideration and enactment of legislation to implement climate plan
- Rulemaking by appropriate departments and agencies
- Implementation of laws and regulations by Administration
- Development and implementation of State Implementation Plans

While a few measures are being undertaken now, most of the reductions are going to have to come later. In this regard, the Administration has pledged that it will not implement the Kyoto Protocol until after ratification.[14] And, while the Administration has stated that it will "reward appropriately" companies that "act early" to cut emissions,[15] it is unclear as to what "early" or "action" means, or what type of credit companies would receive.

This timetable also may make it difficult for businesses to adjust to the significant mandate on reducing energy consumption, make appropriate decisions regarding necessary research and development investments, and reassess business operations. Forcing a premature turnover on capital would exacerbate costs and undermine many businesses' ability to make the substantial cuts that will be necessary over the long term. The Charles River Associates (CRA), an economic consulting firm, found that the establishment of a much longer commitment period would give businesses time to develop more energy efficient technology to reduce emissions, and would help offset the significant economic costs. It also would permit the replacement of much of the existing technology at the end of its useful life, with minimal impact on the ultimate reduction of greenhouse gases in the atmosphere. Furthermore, funds devoted to capital investment with a positive return may result in a greater reduction in emissions in the future than devoting those funds to emission reduction today [16]

The "commitment period" provides flexibility for the United States to average emission levels over the 2008-2012 period, but it may have the effect of forcing the U.S. to make even deeper cuts towards the end of the period. The commitment period is preferable to a single-year target because it provides flexibility in meeting commitments to account for factors such as unexpected economic growth or weather-driven demands for energy in a given year. If, however, the U.S. fails in 2008 to reach 7% below 1990 levels, further cuts would be necessary later in the commitment period to meet the 7% obligation averaged over the five-year period. Given that emissions trading is not expected to be available until 2008, meeting the 7% reduction level by 2008 seems optimistic. Under such a scenario, businesses would need to make even deeper, and immediate, cuts before 2012.

The Kyoto Protocol establishes "differentiated targets," which may have competitive implications for the United States vis-à-vis other Developed Countries. These variable targets were not necessarily based on criteria such as countries' growth, energy usage, levels of efficiencies, or environmental records. Some countries—like Norway (+1%), Australia (+8%) and Iceland (+10%)—successfully negotiated much more modest targets than the U.S. as a condition for their agreement. Undersecretary Eizenstat explained that Australia's commitment, for example, was agreed to because it was the only way to get Australia to join the Protocol, and justified their modest target by the fact that Australia is heavily dependent on coal and is a "relatively small" country.[17]

Others, like the European Union, are much closer to their target than it might seem. The EU commitment is fairly modest because (1) their emissions were relatively high in 1990 due to a robust economy and inefficient energy usage (particularly in East Germany) and (2) since that time, Europe suffered an economic downturn and implemented energy policies for reasons other than climate change (e.g., the U.K.'s conversion from coal to natural gas). Moreover, the Protocol approved the EU "bubble," which permits EU countries to pool their emissions and act, in essence, as a single entity in terms of compliance.[18] As a result, some European nations will be able to continue to increase their emissions.

Conversely, the U.S. must make more drastic cuts to reach its target. The establishment of a 1990 emissions "baseline" disproportionately affects the United States. The U.S. economy was in recession in 1990 (resulting in lower-than-normal emissions), and subsequent economic growth has contributed to a steady rise in emission levels. As the following chart demonstrates, the U.S. has been disadvantaged for having strong economic growth since 1990, after the arbitrarily established baseline.

World Total Carbon Emissions, Annex I Countries[19]

(in million metric tons/year)

Region/ Country	1990 Emission	Projected Emissions in 2010	Kyoto Target v. 1990 Levels	Kyoto Target	Kyoto Gap	Gap Relative to 1990
Japan	308	466	94%	290	176	-57.3%
United States	1337	1803	93%	1243	560	-41.9%
Canada	137	182	94%	129	53	-38.8%
Western Europe	1016	1208	92%	935	273	-26.9%
Australia	100	127	108%	108	19	+19.0%
Former Soviet Union	1029	872	100%	1029	(157)	—
Eastern Europe	309	306	94%	290	16	-5.0%

In addition, while the U.S. remains the largest global emitter of greenhouse gases, the U.S. emission level as a percentage of global emissions is roughly equivalent to the U.S. Gross Domestic Product as a percentage of global economic output.

The inclusion of six greenhouse gases—the three gases originally covered by the FCCC (CO_2, CH_4, and N_2O) and three fluorocarbons (HFCs, PFCs, and SF_6)—slightly reduces the overall U.S. commitment (by increasing the baseline), may serve to protect the three fluorocarbons from more drastic reductions, and provides increased flexibility in reaching emission reductions. The three fluorocarbons added to the Protocol, at the insistence of the U.S., comprise only 2.2% of all greenhouse gas emissions, but they have exponentially higher potential global warming values and much longer atmospheric lives.

- Hydroflurocarbons (HFCs) were developed as a substitute for CFCs that were banned by the Montreal Protocol[20], and are used largely in refrigeration and in semi-conductor manufacturing processes.
- Perfluorocarbons (PFCs) result as a by-product of aluminum smelting and uranium enriching, and are used in semiconductor manufacturing processes.
- Sulfur Hexafluoride (SF_6) is used as an insulator in electrical transmission and distribution systems.

By including these three gases in the Kyoto Protocol, the Administration may have protected them from elimination or the imposition of more stringent controls through a future separate international agreement.

It is important to note that the Montreal Protocol did not prohibit CFC emissions, it banned the use of CFCs. Thus, some companies feared a similar ban on HFC usage could result if the three gases were treated separately in future negotiations. Fluorocarbon emissions between 1990 and 1995 increased significantly as they have been used as a substitute to the banned CFCs. Thus, calculating fluorocarbon from a 1995 baseline, in effect, reportedly lowers the overall U.S. emission reduction commitment by 1%.[21]

III. CARBON SINKS

A carbon sink is a natural system that absorbs CO_2 from the atmosphere and stores it in plants, trees and wood products. However, if not properly managed, forests and other vegetation can also be a source of carbon emissions. In simple terms, healthy trees and plants store carbon, but carbon also escapes (is emitted) through, among other reasons, fire, insect infestation, and decay. To maintain forests as a net sink of carbon dioxide, sustainable and active forest management practices must be adopted to assure that these negative effects can be minimized and prevented. Though unrecognized by the Protocol, oceans are also a major sink of carbon dioxide.

The Administration favored the inclusion of sinks in the Kyoto Protocol to encourage activities like afforestation and reforestation, and to provide the private sector with "low-cost opportunities to reduce emissions."[22] According to the U.S. Department of Agriculture's Forest Service, U.S. forests have a current standing inventory of about 60 billion metric tons of sequestered carbon. The total carbon in forests increases a net of 200 million metric tons annually. In addition, wood products are estimated to store 12 million metric tons of carbon annually.

> **Article 3(3) of the Kyoto Protocol:** The removal of gases by sinks may be used to offset emission reduction commitments if they are the result of "direct, human-induced land-use change and forestry activities." The land-use and forestry activities that qualify are limited, however, to afforestation, reforestation, and deforestation initiatives since 1990, measured as verifiable changes in stocks for the commitment period.

Sinks have tremendous potential as a means of reducing emissions. The Kyoto Protocol permits countries to use certain forestry-related activities that are "human-induced" to offset emission obligations. Activities are limited to afforestation and reforestation. The most recent Intergovernmental Panel on Climate Change (IPCC) guidelines on national greenhouse gas inventories must be used by Annex I parties for inventories due in 1998 and beyond.[23] The IPCC has published estimates of carbon sequestration rates for various tree species and the tons of carbon stored per hectare for different forest cover types. The U.S. Forest Service uses detailed inventory and monitoring of forest plots around the country to estimate and project carbon storage in U.S. forests. While not all methodological issues have been ironed out, forest management activities and their role in sequestering carbon have the potential to offset carbon dioxide emissions. For forestry-related carbon sequestration calculations, there are three methodological approaches described by the IPCC to determine forest carbon sequestration by countries reporting their greenhouse gas inventories.

The Protocol defers consideration, however, of the rules and guidelines for "how and which additional human-induced activities related to changes in greenhouse gas emissions and removals in the agricultural soil and land use change and forestry categories, shall be added to, or subtracted from, assigned amount for Parties..." At this time, we do not know what specific activities will be accepted as additional for offsetting reduction commitments. What is known is that only "net changes" in sinks that are human-induced and occur in the 2008-2012 budget period will count against a country's reduction commitment.[24]

Ultimately, sinks may indeed help the U.S. meet its commitments, but substantial ambiguity surrounds the terms contained in the Protocol's provisions which prevents a fair determination. Some believe that as much as one-quarter of U.S. reductions can be achieved through forestry practices, for example.[25] Simply put, however, it is impossible to predict what role sinks will play in meeting commitments, particularly since the Protocol does not specify what percentage of a nation's reductions target can be met by carbon sequestering activities.[26] According to studies conducted by the IPCC and U.S. academics engaged in forestry research, reforestation, afforestation and improvements in forest productivity may represent one of the most cost-effective approaches to offsetting greenhouse gas emissions.

Many environmental groups originally supported the inclusion of sinks in the Protocol because they believed it would encourage certain "environmentally-friendly" reforestation and soil policies. Since Kyoto, however, some environmental groups have expressed concern about the inclusion of sinks in the Protocol because there is no way to predict how long a sink will last,[27] and because it may result in countries undertaking fewer emissions-cutting activities. Because forests, if unmanaged, may become a source, there is concern that Parties could take credit for reducing emissions when, in fact, they simply deferred emission cuts until later. Other environmental groups, however, continue to support maximum flexibility and cost effective market mechanisms including forestry options to reduce greenhouse gas emissions.[28]

The inclusion of sinks in the Kyoto Protocol does not change the 1990 baseline for the United States, nor the overall reduction commitment. The Protocol does not count carbon-absorbing activities in 1990 against the 1990 baseline; only gross emissions are counted in 1990. Therefore, the United States' 1990 baseline was not changed by the Kyoto Protocol's inclusion of sinks and the U.S. still must cut emissions 7% below 1990 levels. Of course, in the first commitment period of 2008-2012, some amount of positive carbon sequestration amounts (yet to be determined) can be deducted from emissions to meet the 7% reduction target. The Administration has asserted that the fact that sinks are not accounted against the 1990 baseline means that their October 1997 Climate Proposal is much closer to the Kyoto

Protocol than it appears. From an accounting standpoint, this may be achievable with the right incentives, but it does not change the U.S. commitment, and the Administration has yet to describe or quantitatively explain how forest carbon sequestration accomplishes a three percent reduction in the U.S. commitment.

IV. ROLE OF DEVELOPING COUNTRIES

Article 10 of the Kyoto Protocol: The Protocol does not introduce "any new commitments for Parties not included in Annex I" (Developing Countries).

The Kyoto Protocol fails to meet the requirement established by the U.S. Senate in S. Res. 98, the "Byrd-Hagel Resolution," that Developing Countries assume new specific scheduled commitments to limit or reduce emissions within the same compliance period. On July 25, 1997, the Senate unanimously approved—by a 95 to 0 vote—a Sense of the Senate Resolution sponsored by Senators Robert C. Byrd (D-WV) and Chuck Hagel (R-NE) which directed that "the United States should not be a signatory to any protocol ... unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for the Developing Country Parties within the same compliance period."[29] The Administration acknowledges that the involvement of Developing Countries is an essential element of any final agreement and Administration officials have stated repeatedly that they will not even submit the Protocol to the Senate until this has been attained. The Administration's standard, however, is limited to the "meaningful participation" of "key" Developing Countries, a standard which it has thus far refused to define specifically.

Administration officials have suggested that Developing Countries could bind themselves to the Protocol through an amendment to Annex B,[30] and that the "carrot" for getting Developing Countries to make these commitments is that Article 17 of the Protocol permits any country with Annex B commitments to take part in emissions trading. There is an unresolved legal question, however, as to whether an amendment to Annex B would legally bind a Developing Country to its target. Under Article 3, the emission reduction commitments are only binding on Annex I countries, which a Developing Country would not be. If this is so, an amendment to Annex B may represent a voluntary gesture only.

Regardless, in Kyoto, many Developing Countries—led by the two biggest emitters, China and India—defeated a draft article (then known as "Article 10") that would have explicitly provided a means for Developing Countries to take on voluntary commitments of their own choosing. According to Representative John Dingell (D-MI), a member of the Congressional Observer Team in Kyoto, a Chinese delegate steadfastly maintained that China would not agree to emission limitations now, and would not in 2020, in 2050, or ever.[31]

As it now stands, Developing Countries may receive foreign aid to offset the Protocol's economic impact on them and technology transfers from Developed Countries through the Clean Development Mechanism without binding themselves to reduction commitments that might hamper their economic growth. Moreover given the rapidly expanding nature of many Developing Country economies, there is little incentive to lock in to a "baseline" until growth has slowed, and easier, cheaper solutions are at hand. It seems unlikely that these same countries that refused to permit the inclusion of a voluntary "opt-in" provision in the Protocol would now reverse course and accept binding emission reductions.

By way of background, it is relevant that the exclusion of Developing Countries from this agreement was predetermined in 1995, when the parties to the FCCC adopted the Berlin Mandate.[32] The Berlin Mandate—which was agreed to by the United States negotiating team led by then Undersecretary of State Wirth—required the negotiation of quantified emission reduction targets and timetables for Developed Countries and prohibited the imposition of commitments on Developing Countries. Consistent with this mandate, Clinton Administration officials repeatedly asserted post-Berlin that the U.S. and other Developed Countries were responsible for the present concentrations of carbon in the atmosphere and thus must act first to reduce emissions.[33]

The "meaningful participation of key Developing Countries" standard advanced by the Administration in late 1997—in response to the firm standards established in the Byrd-Hagel Resolution—only exacerbated the hostile atmosphere between the U.S. and many Developing Countries. From the Developing Country perspective, the U.S. was most responsible for the greenhouse gas concentration in the atmosphere and achieved economic dominance in doing so. Now, the U.S. was seeking to impose emission restrictions on the Developing Countries to prevent their economic growth. An undercurrent also flowed in Kyoto, reflected in the opposition by Developing Countries to U.S.-proposed flexible market mechanisms, that the United States should be forced to suffer painful economic sacrifices for its past level of emissions. Until this chasm can be bridged, it will likely be difficult to attain the involvement of Developing Countries in the agreement.

In any event, an amendment to Annex B of the Protocol for Developing Country participation presents a "Catch-22" situation: the Kyoto Protocol is not likely to enter into force until the U.S. ratifies it but the Clinton Administration has asserted that the Protocol will not be submitted to the Senate for consideration until there is meaningful participation of key Developing Countries. The Administration now suggests that it may seek to negotiate a "supplementary" protocol that would enter into force contemporaneous with the Kyoto Protocol.[34] Such an approach could open the Protocol to negotiations on all issues, not just Developing Country participation.

Without full participation by Developing Countries, the Kyoto Protocol will not lead to a net reduction of global greenhouse gas emissions. The outgoing chairman of the IPCC, Dr. Bert Bolin, has affirmed that without Developing Country participation, the Kyoto Protocol will have a negligible impact on global emissions because Developing Countries are becoming the world's largest emitters.[35] While Developing Countries accounted for less than 40% of 1990 global emissions, they are projected to account for more than 50% of global emissions by about 2015. China's emissions are scheduled to triple by 2015, when it will pass the U.S. as the world's leading emitter, and its emissions will increase almost five-fold by 2025.[36]

The IPCC has reported that, given the interrelated nature of the global economic system, attempts to mitigate climate change through actions in one region or sector may have offsetting economic effects which risks increasing the emissions of other regions and sectors. This process, known as "carbon leakage," could result in the migration of energy-intensive production—

including the chemicals, steel, petroleum refining, aluminum and mining industries—from countries constrained in their emissions to those countries not similarly constrained. In addition to loss of jobs, the movement of industry to the Developing Countries would result in even greater emissions of greenhouse gases from these unrestricted countries. Thus, for the Protocol to have a significant impact on man-made greenhouse gas emissions, it must be global in nature and cover all of the world's leading emitters.

V. COMPLIANCE AND ENFORCEMENT

The Kyoto Protocol establishes—for the first time ever––legally binding emission reduction targets and timetables for Annex I countries. In advance of Kyoto, the Parties decided that legally binding measures were necessary because nearly every Developed Country was projected to fail to meet the aim established in the Framework Convention to return to 1990 levels by the year 2000. Moreover, the IPCC's second report, which stated that "the balance of evidence suggests a discernible human influence on global climate," added political momentum to the need for legally binding commitments. However, the Protocol is silent as to when a Party would be in noncompliance, and how the Protocol would be enforced against a Party in noncompliance.

Article 8 of the Kyoto Protocol: The Protocol establishes "expert" review teams that will review national inventories and communications, and provide a "thorough and comprehensive technical assessment of all areas of implementation." It is not clear, however, if these teams will determine compliance through the assessment process. The expert teams are to be nominated by Parties to the Convention and serve under the authority of the Secretariat. No qualifications or requirements for team members were offered.

Article 18 of the Kyoto Protocol: The procedures and mechanisms to determine and address cases of noncompliance must be approved at the first meeting of the Parties to the Protocol (i.e., after the Protocol enters into force). Included in this effort will be an effort to develop "an indicative list of consequences, taking into account the cause, type, degree, and frequency of noncompliance." Any procedures and mechanisms entailing binding consequences (i.e. enforcement) must be adopted by means of amendment to the protocol.

Article 3(2) of the Kyoto Protocol: Each Developed Country must show "demonstrable progress" in achieving their commitments by the year 2005.

While the U.S. government will monitor domestic compliance, international review teams will review the data, assess the implementation of the commitments of the Parties, and identify any problems in, and factors influencing, the fulfillment of the commitments. The Protocol requires each Party to have in place a national system for the estimation of man-made emissions of all greenhouse gases,[37] and the methodologies for estimating emissions must be accepted by the IPCC and agreed upon by the Conference of Parties. The IPCC and the technical subsidiary bodies are charged with constantly reviewing and, if appropriate, revising these methodologies subject to approval by the Parties.

In addition to the international process for determining compliance, the U.S. will have responsibility for monitoring compliance with its commitments. Presumably, specific industries and companies will have caps placed on their emissions (as would be required for an emissions trading regime to exist). Therefore, the U.S. government (most likely through the Department of Energy, the Department of Agriculture, and the Environmental Protection Agency) would need to promulgate regulations and monitor compliance with the caps and other limitations.

The issue of enforcement is central to the Protocol; the United States should not agree to mandatory emission reductions if there is no way to ensure compliance by other Parties. The Protocol must include the mechanisms to ensure that all countries are pulling their weight, because one country's failure to act could give it a competitive advantage over the United States. Moreover, a country that fails to live up to its commitments by emitting excessive greenhouse gases could offset the reductions of those countries in compliance, thereby eviscerating any environmental benefit.

That said, however, it must be realized that such a mechanism carries with it a trade-off against national sovereignty for all countries. The data compiled by the U.S. government will be reviewed by international expert review teams, which will be composed of "experts" nominated by Parties to the FCCC and coordinated by the Secretariat of the Convention. The Protocol does not give these expert review teams explicit authority to inspect private facilities, and the Administration has assured that United Nations teams would not be permitted to do so absent approval from the U.S. government and the company or individual involved.[38] Nevertheless, the Protocol does not prohibit such practices, and it is possible that, for example, participation in emissions trading or joint implementation could require a heightened level of supervision by international authorities. Moreover, while the Administration claims that a private entity must invite an international team onto its property, it has not excluded the possibility that failure to consent to such a visit may have ramifications.

The targets and timetables for the reduction of greenhouse gas emissions imposed on Developed Countries are legally binding, but the Protocol does not specify what would be deemed noncompliance. Not only does the Kyoto Protocol set specific emission reduction targets within a specific time frame, it eventually may include rules and procedures for emissions trading, joint implementation with other Annex I countries, and involvement with the Clean Development Mechanism (see pg. 27), among other issues. What actions or inactions by a Party would be deemed noncompliance, however, will not be determined until the first meeting of the Parties to the Protocol (i.e. after the Protocol enters into force) at the earliest. The Protocol requires that any "procedures and mechanisms" which entail "binding consequences" must be adopted as an amendment to the Protocol.[39]

The Kyoto Protocol does not address how the commitments would be enforced. A further question exists as to whether the penalties adopted will be sufficient to ensure compliance. Penalties could, for example, be as minor as a warning or could include substantive restrictions such as an exclusion from emission trading (as has been suggested by the U.S.) and other flexible mechanisms, or a fine to be paid into the Clean Development fund. On the more severe end, penalties could mandate additional emission reductions or provide for the imposition of trade sanctions. In one instance, the Protocol does specify a penalty for noncompliance, requiring that a Party must be in compliance with its obligations under Article 5 (which requires Parties to have a national system to estimate emissions by sources and removal by sinks) and Article 7 (which requires annual inventory and national communications requirements) to acquire emission reduction units from another Party through joint implementation projects.[40]

Of perhaps even greater concern, the United States could be strictly bound by the Protocol even if the international enforcement mechanism is lax. U.S. law provides for citizen suits to mandate compliance with certain laws, such as environmental laws. Thus, a U.S. citizen or party may be able to sue to enforce the U.S. commitments under the Protocol. Under such a circumstance, the Federal Courts could intervene to force compliance with the Protocol if the Administration or the Congress fails to act.

The first enforceable goal of the Kyoto Protocol, that Developed Countries show "demonstrable progress" in meeting their commitments by 2005, is undefined, and the penalty for failure to achieve this requirement is undetermined. The term "demonstrable progress" is not defined in the Protocol and, since there are no noncompliance or enforcement mechanisms in place, it is uncertain what would happen to a country that fails to achieve demonstrable progress. Given that the Protocol also mandates the initiation of negotiations for new reduction commitments by 2005,[41] it is possible that failure to achieve demonstrable progress could be used by Parties to the Protocol to leverage the need for additional measures. (A similar scenario occurred in Berlin in 1995, where the Parties to the FCCC judged the voluntary aims set only three years earlier as "inadequate" and decided to pursue mandatory reduction measures.) For example, the European Union strongly favors the adoption of mandatory policies and measures to force compliance (like carbon taxes, CAFÉ, etc.), and its negotiating position could be enhanced if demonstrable progress is not achieved.

VI. FLEXIBLE MARKET MECHANISMS

In Kyoto, the Administration proposed and urged the adoption of flexible, market-based approaches to achieve emission reductions. In particular, an emissions trading system embracing free-market principles with all major global emitters could help ease the potentially severe costs of compliance with the emission reduction commitments.

Article 3 of the Kyoto Protocol—which sets the terms for emission reduction requirements—permits Developed Countries to acquire from, or transfer to, one another emission reduction units in accordance with Article 6 (joint implementation) and Article 17 (emission trading). The Kyoto Protocol provides for joint implementation with Developing Countries through a newly created "Clean Development Mechanism," which requires additional actions on the part of Developed Countries to get credit for projects. In general, the use of market-based mechanisms is forecast to reduce the costs of compliance as compared to command-and-control type approaches. Based on the current status of these mechanisms in the Kyoto Protocol, however, it is impossible to rely with any certainty on their ultimate availability, or to project the cost savings that might be attained from their use.

Joint Implementation (for Annex I Countries)

> **Article 6 of the Kyoto Protocol:** "Any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks," provided that, among other things:
>
> - The project provides a reduction in emissions that is "additional to any that would otherwise occur"; and
> - The acquisition of emission reduction units is "supplemental to domestic actions" for the purposes of meeting commitments.

The Kyoto Protocol does not resolve the major issues in terms of how joint implementation between Annex I countries would work. This Article allows Parties (i.e. Developed Countries) to earn reduction credits through their involvement in certain projects that reduce emissions in other Developed Countries, but it does not establish how the credits would be determined. It does not provide explicitly for participation by companies, though it has been assumed that companies would be able to participate for credit. Other more complicated issues exist such as how the Article would address the situation where a multinational corporation undertakes a project in another country where it operates.

The Article's caveat that credits are limited to reductions that are "additional to any that would otherwise occur" is particularly troubling. In essence, this limitation appears to require a judgment of the motives of an individual country or company. Presumably, to determine whether a particular project that reduces emissions meets this standard, a UN review team will assess the merits of the project to determine not only how much of a reduction was realized but whether the project would have been undertaken for any other reason. The Article seems to connote that a profitable venture, for example, is not deserving of credit for any reduction realized. If this is the case, and we will not know until the rules and guidelines are formulated, joint implementation will have very limited value.

In addition, the limitation that the acquisition of reduction units be "supplemental to domestic actions" remains undefined. Reportedly, initial discussions in Kyoto as to the permissible amount of reductions that could be achieved through joint implementation and count towards the overall commitment of a country were shelved because the proposed limit was so low. Guidelines and rules for the implementation of Article 6 are not scheduled to be developed by the Parties until after the Protocol enters into force.[42]

Emissions Trading

Ideally, through the mechanism of emissions trading, countries and companies will be able to purchase less expensive emissions permits from companies or countries that have more permits than they need. While the concept of emissions trading is "enshrined" in the Protocol, almost all of the details remain unresolved and, again, cannot be approved until after the Protocol enters into force.

Article 17 of the Kyoto Protocol:

- Allows Parties included in Annex B to "participate in emissions trading for the purposes of fulfilling their commitments under Article 3."
- Requires the Conference of the Parties to the FCCC to define the "relevant principles, modalities, rules and guidelines, in particular for verification, reporting, and accountability for emissions trading."
- Limits emissions trading to that which is "supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments" under Article 3.

The Kyoto Protocol does not resolve any of the major issues with regard to how an emissions trading program would work. As with joint implementation, a myriad of fundamental questions remain unexplored and unresolved with respect to emissions trading. Some of these issues include:

- what constitutes an emissions credit;
- how initial allocations of emissions units would be made;
- who would be permitted to make trades;
- what institutions or mechanisms would be required (and whether they would be exclusive) and how they would be funded;
- who would bear the risks and costs of failures in the trading system; and,
- how monitoring and compliance would operate or be enforced.

Even more complex issues include whether multinational companies could trade within their own firms across international borders. Furthermore, there are questions as to whether there will even be a pool of emissions reduction units available to trade (the units that exist as a result of reaching commitments with "room to spare") and, if so, whether there would be sufficient buyers and sellers in the marketplace to realize any economic benefit at all. All of these issues will need to be resolved through negotiations and at future Conferences of the Parties to the FCCC.[43]

As was discussed in the previous section on joint implementation, what would qualify as an emissions reduction unit that is "supplemental" to domestic actions has not yet been determined. But, the EU, with the support of Developing Countries, intends to work to establish a limitation on the total amount of emission reduction commitments a country could satisfy through emissions trading, perhaps as little as 10%-50% of a Party's commitment. In contrast, the EU will have access to unlimited trading within its bubble. Such a narrow limitation would present a serious problem for the United States' compliance effort, since the Administration has thus far only been able to account for roughly 26% of its targeted reductions through programs identified in the 1997 Climate Action Plan and, thus, may need to rely on market mechanisms such as emissions trading to meet as much as 74% of its commitment.

Without Developing Country participation, the potential for a successful international emissions trading scheme is greatly diminished. A vibrant market requires numerous participants, and buyers and sellers who are differently situated, in order to create economic incentives and efficiencies. Efficient control opportunities are much greater in China, the former Soviet Union, and other developing countries than they are in the developed regions.[44] Dr. Yellen, the Chair of the President's Council of Economic Advisors, agreed that "developing country participation is crucial because it would permit relatively low-cost emissions reductions to be internationally recognized as a substitute for more expensive emissions reductions that might otherwise be achieved domestically by U.S. companies and those in other industrialized countries."[45] Several economic analyses—including ones by the Organization for Economic Cooperation and Development (OECD)[46] and the National Economic Research Associates (NERA)[47]—agree that any program to limit global climate change would have to involve the participation of non-Annex I countries in order to be efficient and cost-effective. Moreover, no one buyer or seller should dominate the market and independently influence the market price."[48]

The true costs of, and potential savings from, emissions trading are completely unknown. In October 1997, President Clinton proclaimed that by providing incentives for early action, attacking domestic energy inefficiencies, and putting in place a market-based emissions trading system, the U.S. could reach 1990 levels by 2008-2012 with "minimal economic costs." For many of the reasons stated above, emissions trading may not substantially lower costs. For a market system to function effectively, it must be competitive and the transaction costs—including the costs necessary to identify a trading partner, make proposals, execute negotiations, and ensure the completion of obligations under any resulting contract—must be low. These costs are unknown at this time, but will be impacted by the exclusion of Developing Countries. Not withstanding, the net effect of emissions trading results in increased costs to U.S. manufacturers whose competitiveness may become jeopardized. Emissions trading entails a cap on energy use, results in energy rationing and higher energy costs in "addition" to the costs of purchasing emissions credits.

According to the Joint Economic Committee, "… for a tradable emissions program to work, not only must the regulatory authorities have confidence in their ability to monitor emissions, but the market participants must also have confidence that their investment in emissions rights is protected from cheating by emission sources."[49] No such assurances are currently available in the global marketplace for greenhouse gas emissions reductions since compliance and enforcement rules have not been established.

Finally, a domestic emissions trading scheme will not be available until 2008.[50] That means that Parties may have little opportunity to utilize a trading scheme, even if an acceptable free market system is established, in time to meet commitments required in 2008.

Clean Development Mechanism

The Clean Development Mechanism ("CDM") enables Developed Countries to undertake emission reduction projects in Developing Countries for credit. Unlike Joint Implementation, however, additional requirements must be met and a fee must be paid into a fund for the Developing Countries. The CDM also may help reduce compliance costs, though again the rules have not yet been developed.

Article 12 of the Kyoto Protocol: Developed Countries may invest in projects in Developing Countries and use certified emissions reductions achieved through these projects to meet emission reduction commitments, subject to the following limitations:

- Emission reductions achieved through CDM may only be used to satisfy a "part" of a country's reduction commitments.
- Only reductions that are "certified" by "operational entities" yet to be identified or created can be used to satisfy reduction commitments; and,
- Only projects that result in "real, measurable, and long-term benefits" may be included and then only if such reductions are "additional to any that would occur in the absence of the certified project."

The Kyoto Protocol does not establish how much credit a Developed Country can receive for participating in emission reduction efforts through the CDM. Emission reductions achieved through CDM may only be used to satisfy a "part" of a country's reduction commitments. The exact portion allowed will not be determined by the Parties until after the Protocol enters into force.

The Kyoto Protocol does not establish what kinds of projects can be used to satisfy reduction commitments through CDM. Only reductions that are "certified" by "operational entities" yet to be identified or created can be used to satisfy reduction commitments. Only projects that result in "real, measurable, and long-term benefits" may be included and then only if such reductions are "additional to any that would occur in the absence of the certified project." Until these rules are established, it will be difficult for companies to assess the viability of undertaking emission reduction projects in the Developing Countries.

The Kyoto Protocol has not decided by whom the CDM will be operated. The composition of an executive board to oversee the CDM and the modalities and procedures for ensuring "transparency, efficiency and accountability through independent auditing and verification of project activities" have not yet been decided.[51] The costs of establishing and maintaining these institutions and bodies, of course, are completely unknown. It appears, however, that significant transaction costs will accompany any reductions that may be achieved through the CDM mechanism.

The Kyoto Protocol does not address how much of a "fee" will be charged to Developed Countries for participating in CDM projects. Even though the projects themselves would be financed by Developed Countries entities, Article 12(8) provides that the Parties to the Protocol "shall ensure that a share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist Developing Country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation." Like many other aspects of the Kyoto Protocol, the share of the proceeds that must be donated to Developing Countries—which will be the primary beneficiaries of the projects themselves—is to be determined by the Parties to the Protocol, including the Developing Countries which have nothing to lose and everything to gain in insisting on the receipt of a significant portion of any profits generated by CDM projects.

The "Umbrella" Option

Article 4 of the Kyoto Protocol: Any Annex I Parties that have reached an agreement to fulfill their commitments under Article 3 jointly shall be deemed to have met those commitments provided that their total combined emissions do not exceed their commitments in Annex B. Ultimately, however, each Party is responsible for its own Annex B commitment if the entity formed fails to meet its overall commitment.

Article 4 was drafted to authorize and regulate the EU Bubble. It establishes a mechanism for setting emission reduction targets for countries desiring to meet their obligations jointly. This arrangement allows alteration of national emission targets assigned in Annex B provided that the total emissions of the cooperating countries do not exceed their current aggregate total as listed in Annex B. It further specifies that, if the cooperating countries do not meet their joint obligation, each country is responsible for meeting its individual target as specified in the revised Annex B.

Although Article 4 allows non-European nations to form their own bubble agreements, the non-compliance mechanism will limit the extent to which this cooperative mechanism is used. The United States, for example, is highly interested in crafting an emissions trading umbrella which would include many of the non-EU OECD nations (including Japan, Canada, Australia, and New Zealand) plus Russia and the Ukraine. Due to the potential implications of the compliance mechanism, however, the umbrella countries are pursuing an arrangement to trade cooperatively under Article 17. Such an approach would not set joint obligations or revise the obligations of individual participants under Annex B. Given the potential ramifications of failing to meet a joint target under Article 4, it is difficult to imagine a proliferation of such arrangements outside of regional economic organizations that are moving towards a common economy and political integration.

VII. POSSIBLE ESTABLISHMENT OF MANDATED "POLICIES AND MEASURES"

One of the major disagreements on global climate policy between the United States and the European Union has been over whether specific policies and measures should be required by the Kyoto Protocol or subsequent global climate agreements.

Article 2(1) of the Kyoto Protocol: Parties may "implement and/or further elaborate policies and measures in accordance with its national circumstances" to meet their commitments under the Protocol. Suggested policies and measures include:

- enhancement of energy efficiency;
- promotion of sinks and sustainable forms of agriculture;
- development and increased use of renewable forms of energy;
- reduction or phasing out of fiscal incentives, tax exemptions, and subsidies in all greenhouse gas emitting sectors that run counter to the objectives of the Convention; and,
- measures to limit and/or reduce emissions in the transport sector.

The Kyoto Protocol permits Parties to make their own determinations domestically as to how they intend to meet their emission reduction commitments, but some countries will likely continue to urge the adoption of mandatory policies and measures. The Clinton Administration has advocated that each country should be permitted to meet its commitments based on its own national circumstances. According to the EU and many of the Developing Countries, however, the Parties to the Protocol should set mandatory, harmonized policies and measures to implement the Protocol including, for example, carbon taxes and CAFÉ standards. In this regard, the EU's original climate proposal contained eighty-seven policies and measures that it would like to see mandated for adoption by all Parties to the Protocol.

The risk at this stage, as discussed extensively in previous sections, is that much work remains to be done to make the Kyoto Protocol, and/or a subsequent global climate agreement, acceptable to the United States. Just as the Clinton Administration seeks to negotiate rules and guidelines for the flexible mechanisms, like emissions trading, and to include Developing Country

Parties in the agreement, the EU will continue to push for the adoption of mandatory polices and measures.

It seems unlikely that the Clinton Administration would agree to mandatory policies and measures at this time. However, this issue could arise again if a "supplementary" protocol is negotiated or, in 2005, when Parties to the Protocol are scheduled to consider new commitments for the post-2012 period and evaluate whether Developed Countries have made "demonstrable progress" towards achieving their targeted emission reduction commitments. If the United States, in particular, cannot make such a demonstration, there could be significant pressure on the U.S. to agree to mandatory emission reduction policies.

VIII. LONG-TERM GOALS OF THE FRAMEWORK CONVENTION

Article 2 of the Framework Convention sets a long-term goal of achieving the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The FCCC also directed that "[s]uch a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." At this point in time, no one knows for sure what concentrations of greenhouse gases would create "dangerous anthropogenic interference" with the climate. However, the European Union has proposed that concentration levels lower than 550 parts per million of carbon dioxide should guide global limitation and reduction efforts.[52] President Clinton has proposed that the National Academy of Sciences participate in setting the concentration goal.[53]

According to one of the chief architects of the Clinton Administration's climate policy, former Undersecretary of State Timothy Wirth, the United States (and presumably other major emitters) would have to reduce emissions more than 70% below 1990 levels to stabilize greenhouse concentrations, and even reductions at this level might not prevent temperature increases and rising sea levels.[53] The IPCC has similarly concluded that drastic reductions in current global emissions would be necessary to stabilize concentration levels.[55]

The Kyoto Protocol is a small step towards much larger, yet thus far undefined, emission reductions. Even if all Developed Countries were able to honor their emission reduction commitments, the level of CO_2 in the atmosphere in 2010 is projected to increase 8% over 1990 levels. This is due to the continued growth in energy demand and thus emissions by Developing Countries, which will more than offset the reductions made by Developed Countries. Overall, the Kyoto Protocol would reduce the concentration of CO_2 in the atmosphere by only 1.5 parts per million, which is just 0.4% as opposed to the business-as-usual path (see chart below).[56] And, these projections assume that Developed Countries will be able to fully satisfy their commitments, which is not at all a certainty.

Concentration of CO_2 in the Atmosphere

(parts per million)

	Year 1990	Year 2010
Business-as-usual path	353	383.5
With full compliance to Kyoto Protocol		382.0

Source: Dr. Bert Bolin, Intergovernmental Panel on Climate Change.

After the year 2012, the Kyoto Protocol does not set forth any further reductions, providing simply that, by 2005, "commitments for subsequent periods" be considered and adopted as amendments to the Protocol.[57] Likewise, the President's October 1997 Climate Proposal only mentions "reductions below 1990 levels" in the 2013-2017 time period, and additional cuts thereafter.[58] The President has not indicated how much further the United States and other countries will have to cut emissions, and in what time frame.

IX. EXEMPTION FOR CERTAIN UNITED NATIONS-SANCTIONED MILITARY ACTIVITIES

The United States Department of Defense is the largest single emitter of greenhouse gases within the U.S. government, itself the largest U.S. emitter of greenhouse gases. To ensure military readiness and national security concerns, U.S. industries may be saddled with additional emission reductions to the extent domestic military operations are included in the U.S. emissions baseline, national inventories, and targets.

A technical paper which accompanies the Kyoto Protocol and was adopted as a "decision" of the Conference of the Parties exempts certain UN-sanctioned military emissions.[59] The Decision states that "emissions resulting from multilateral operations pursuant to the United Nations Charter shall not be included in national totals, but reported separately. Emissions related to other operations shall be included in the national emissions totals of one or more Parties involved."

The limited military exemption could compromise U.S. national security. The Administration has assured the Congress that everything that the Department of Defense "outlined to protect military operations and our national security" was achieved.[60] The Administration interprets the decision as "... exempt[ing] key overseas military activities, including exemptions for 'bunker fuels' ... and for emissions resulting from a wide range of multilateral operations, such as peacekeeping and humanitarian relief."[61] In contrast, a group of leading American statesmen and foreign policy experts[62] has warned that unilateral military actions will become "politically and diplomatically more difficult" if the Kyoto Protocol enters into force and the U.S. is a party. For example, this could result in the United States compromising economic policy at home or foreign policy objectives abroad.

By exempting certain military emissions, U.S. businesses may be forced to make even deeper cuts to compensate for essential military activities that cannot be curtailed. Under the terms of the Protocol, the United States will still be required to report all emissions from military sources. If the bulk of the emissions from the largest U.S. emitter of greenhouse gases is "off the table," U.S. industry and agriculture may have to compensate by further reducing emissions. According to the Administration, the Department of Defense has already instituted measures to limit their emissions, and significant reductions have been achieved through base closings. Ultimately, however, whatever level of activity that is required to ensure military readiness and national security concerns will be of paramount importance, and the U.S. would need to offset any such emissions from other sources.

In addition, the technical paper permits countries to "decide among themselves how to account for emissions relating to multilateral operations (e.g., U.S. training in another NATO country) without going through emissions trading." To the extent the U.S. agrees to include military emissions abroad in the U.S. baseline, the U.S. emissions total would increase further and require deeper reductions.

X. AVIATION AND MARINE BUNKER FUELS

The targets and timetables established by the Kyoto Protocol cover greenhouse gas emissions for most sectors of the economy, but emissions from international aviation and marine sources are not covered to reflect prior international obligations and, in part, because of the difficulty in allocating emissions in international airspace or waters to specific countries. Article 2(2) of the Kyoto Protocol states that emission limitations or reductions not controlled by the Montreal Protocol from aviation and marine bunker fuels should be pursued through the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) respectively.

With regard to aviation sources, the Chicago Convention of 1944 established ICAO as the UN agency with exclusive competence to promulgate rules governing all aspects of international aviation. Since 1977, ICAO has promulgated binding standards on international aircraft emission and noise. Given the recent interest of both ICAO[63] and IMO[64] in curbing air pollutants, both organizations appear capable of considering greenhouse gas emission reduction policies in the near term. If these groups fail to act within a reasonable time period, or act in a manner deemed insufficient by the Framework Convention, however, the Kyoto Protocol may seek to act to address these sources.

XI. CONCLUSION

On October 24, 1997, The Business Roundtable, in a letter to President Clinton, opposed the binding targets and timetables proposed in the President's October 1997 Climate Proposal because neither the Administration nor the business community had a firm grasp of the economic sacrifices that our society will be required to make, and it was not clear that targets and timetables were required by the science and the yet to be determined long term concentration goal. The Business Roundtable also commended the President for urging the inclusion of Developing Countries. We explained that the inclusion of Developing Countries in an enforceable system is essential for an emissions reduction agreement to work, and warned that a program which resulted in competitive disparity could lead to a migration of jobs and investment from the developed world to the less developed world.

The U.S. Senate shared these concerns in the unanimously adopted Byrd-Hagel Resolution, which calls on the President not to sign any protocol that (1) does not include new specific scheduled emission reduction or limitation commitments for Developing Countries in the same compliance period; or (2) would result in serious economic harm to the United States.

Unfortunately, as the foregoing analysis makes clear, the Kyoto Protocol fails on both counts and, accordingly, we would urge the President not to sign the Kyoto Protocol at this time. Simply put, the Kyoto Protocol raises many more questions than it answers, and leaves too many gaps unfilled. The Protocol fails to address the global nature of the issue by not requiring any action by Developing Countries to reduce or limit their emissions. And, even today, we are still unable to assess the full economic ramifications of the Protocol.

The Business Roundtable recognizes that every detail cannot be worked out prior to signing an international agreement, but we have concluded that the current agreement fails to meet the threshold for us to sufficiently analyze and assess the agreement and its implications.

We do commend the President for achieving the inclusion of some important provisions in the Protocol, which should be retained in any future agreement. These include the concept of flexible market mechanisms; the rejection of mandatory policies and measures; the budget commitment period; and the inclusion of six gases.

Understanding the complex nature of the global climate and addressing the situation in a responsible and prudent manner takes time. The Business Roundtable has previously urged all parties to avoid a rush to judgment, and we still believe this is good advice. Let's work together to understand the issue and how we should act, rather than acting hastily in a way that just might exacerbate the problem or create new ones.

While The Business Roundtable must oppose the Kyoto Protocol in its current form, we are committed to remaining an active participant in this critical debate on the global climate. We pledge to work in cooperation with the U.S. government and other interested parties to ensure future generations will have a healthy economy and environment and enjoy an ever-increasing standard of living.

APPENDIX

Annex I Countries

- Australia
- Austria
- Belgium
- Bulgaria
- Canada
- Croatia
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Italy
- Japan
- Latvia
- Liechtenstein
- Lithuania
- Luxembourg
- Monaco
- Netherlands
- New Zealand
- Norway
- Poland
- Portugal
- Romania
- Russian Federation
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland
- Ukraine
- United Kingdom
- United States

ENDNOTES

[1] A list of Annex I countries can be found in the Appendix. One Annex I country, Turkey, formally requested its removal from Annex I and it did not undertake commitments in the Kyoto Protocol. In addition, Czechoslovakia was deleted from Annex I, and the Czech Republic, Slovakia, Croatia, Slovenia, Liechtenstein, and Monaco were added as Annex I parties.

[2] The Clinton Administration claims that the 7% reduction is, in effect, only 3% lower than its October 1997 Climate Proposal (which proposed stabilization at 1990 levels) due to the inclusion of six gases and the treatment of sinks.

[3] Kyoto Protocol, Article 24.

[4] Kyoto Protocol, Article 25.

[5] Undersecretary of State Stuart Eizenstat, Senate Foreign Relations Committee hearing, February 11, 1998.

[6] Eizenstat, House Commerce Committee, Energy and Power Subcommittee hearing, March 4, 1998.

[7] *See e.g.*, Eizenstat, House Commerce Committee, Energy and Power Subcommittee hearing, March 4, 1998.

[8] Energy Information Administration, Annual Energy Outlook 1998, November 7, 1997.

[9] Carbon dioxide represents approximately 85% of U.S. greenhouse gas emissions.

[10] Flexible market mechanisms are discussed in detail in section V, and sinks in section II.

[11] Undersecretary of State Timothy E. Wirth, Senate Foreign Relations Committee, International Economic Policy Subcommittee hearing, June 19, 1997.

[12] The United States Constitution gives the President the power to make treaties, "by and with the Advice and Consent of the Senate...provided two thirds of the Senators present concur." The United States Constitution, Article 2, section 2, clause 2.

[13] President Clinton's Climate Policy, October 1997.

[14] *See, e.g.,* Eizenstat, Senate Foreign Relations Committee hearing, February 11, 1998.

[15] President Clinton's Climate Policy, October 1997.

[16] Charles River Associates, "Economic Implications of the Adoption of Limits on Carbon Emissions from Industrialized Countries," November 1997.

[17] Eizenstat, Senate Agriculture Committee hearing, March 5, 1998.

[18] The umbrella option, which is discussed in section V(D), may also be available for other Parties.

[19] Data for the United States derived from the Energy Information Administration's Annual Energy Outlook 1998, November 7, 1997; all other data from the EIA April 1997 International Energy Outlook.

[20] The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer aims to reduce and eventually eliminate the emissions of CFCs, which are man-made, ozone-depleting substances.

[21] "The Kyoto Protocol on Climate Change" Fact Sheet, released by the Bureau of Oceans and International Environmental and Scientific Affairs, U.S. State Department, January 15, 1998.

[22] "The Kyoto Protocol on Climate Change" Fact Sheet, January 15, 1998.

[23] These guidelines have been approved by the IPCC-XII and the Subsidiary Body for Scientific and Technological Advice.

[24] "The Kyoto Protocol on Climate Change" Fact Sheet, January 15, 1998.

[25] See, e.g., Testimony of Senator Ron Wyden (D-OR), Senate Agriculture Committee, March 5, 1998.

[26] The Protocol also does not determine what percentage of a Party's reduction targets can be achieved through emissions trading, joint implementation or the Clean Development Mechanism.

[27] Kevin Jardine, Greenpeace spokesman, *The Ottawa Citizen,* December 7, 1997, p. A1.

[28] Parties to the Kyoto Protocol will likely need to examine the rules, modalities and guidelines as they pertain to this situation as specified in Article 3.4.

[29] S. Res. 98.

[30] Eizenstat, House Energy and Power Subcommittee hearing, March 4, 1998.

[31] Dingell, House Energy and Power Subcommittee hearing, March 4, 1998.

[32] The FCCC—which contained only voluntary commitments—first established the classifications of Annex I and non-Annex I countries for differentiated treatment.

[33] *See, e.g.,* statements of Undersecretary of State Timothy E. Wirth, Senate Energy and Natural Resources Committee hearing, September 17, 1996; statement of Assistant Secretary of State Eileen Claussen, House Energy and Power Subcommittee, September 26, 1996.

[34] Id.

[35] "The Kyoto Negotiations on Climate Change: A Science Perspective," by Bert Bolin, *Science,* January 16, 1998.

[36] "Who Will Fuel China?" by Thomas E. Drennen and Jon D. Erickson, *Science,* March 6, 1998.

[37] The system must be in place no later than one year prior to the start of the first commitment period (2007). Article 5(1).

[38] Eizenstat, House Commerce Committee, Energy and Power Subcommittee hearing, March 4, 1998.

[39] Kyoto Protocol, Article 18.

[40] Kyoto Protocol, Article 6(1)(c).

[41] Kyoto Protocol, Article 3(9).

[42] Kyoto Protocol, Article 6(2).

[43] The Conference of the Parties to the Framework Convention is given the authority to define the relevant rules for emissions trading. Kyoto Protocol, Article 17. Initial discussions will take place in June 1998, and are expected to continue at the November 1998 Conference of the Parties in Buenos Aires.

[44] Norhaus and Yang, "A Regional Dynamic General-Equilibrium Model of Alternative Climate Change Strategies," *American Economic Review* 86(4):741-765 (1996).

[45] Yellen, House Energy and Power Subcommittee hearing, March 4, 1998.

[46] OECD "Global Warming: Economic Dimensions and Policy Responses" (1995).

[47] Dr. David Harrison, Jr., National Economic Research Associates, "Considerations in Designing and Implementing an Effective International Greenhouse Gas Trading Program" (October 1997).

[48] Joint Economic Committee Study, "Tradable Emissions," (July 1997), at 4.

[49] Id.

[50] President Clinton's Climate Policy, October 1997.

[51] Kyoto Protocol, Article 12(7).

[52] "EU Conclusions on Climate Change," as agreed by the meeting on the EU Council of Environment Ministers, March 3, 1997, citing the Council's conclusions from June 1996.

[53] President Clinton's Climate Policy, as released at the National Geographic Society on October 22, 1997.

[54] Wirth, Senate Foreign Relations Committee hearing, June 19, 1997.

[55] IPCC Second Assessment Synthesis of Scientific-Technical Information relevant to interpreting Article 2 of the UN Framework Convention on Climate Change, Article 4.10.

[56] Dr. Bert Bolin, the outgoing Chairman of the IPCC, quoted in *The Washington Post,* February 13, 1998, p. A14; "The Kyoto Negotiations on Climate Change: A Science Perspective," by Bert Bolin, *Science,* January 16, 1998.

[57] Kyoto Protocol, Article 3(9).

[58] President Clinton's Climate Policy, October 1997.

[59] Decision 2/CP.3, "Methodological issues related to the Kyoto Protocol."

[60] Eizenstat, House Energy and Power Subcommittee hearing, March 4, 1998.

[61] Id.

[62] Members of the group, called COMPASS, include, among others, Jeanne Kirkpatrick, former Ambassador to the UN; former Secretaries of Defense Richard Cheney, Caspar Weinberger, and Frank Carlucci; and former Secretaries of State Lawrence Eagleberger and Alexander Haig.

[63] ICAO has issued Standards and Recommended Practices for other aircraft emissions (not greenhouse gas-specific) under the provisions of the Convention on International Civil Aviation.

[64] On September 26, 1997, Parties to the International Convention of the Prevention of Pollution from Ships agreed to new rules to set limits on sulfur oxide and nitrous oxide emissions from ship exhausts and prohibit the deliberate emissions of ozone depleting substances. Fact sheet from IMO Conference on Air Pollution Prevention, September 15-26, 1997.

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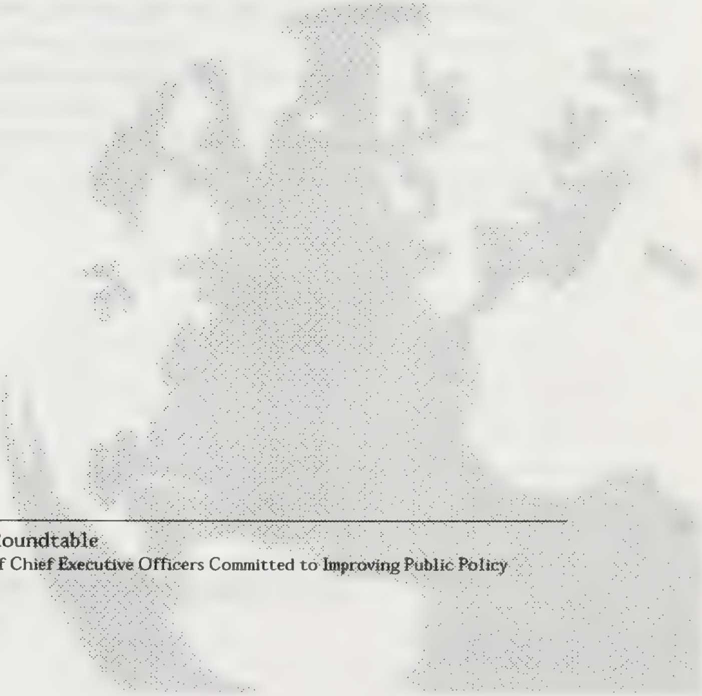
Environment Task Force

The Kyoto Protocol

A Gap Analysis

June 1998



The Business Roundtable
An Association of Chief Executive Officers Committed to Improving Public Policy

Environment Task Force

The Kyoto Protocol

A Gap Analysis

A White Paper from THE BUSINESS ROUNDTABLE
June 1998

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EXECUTIVE SUMMARY

In an in-depth analysis of an international agreement to curb greenhouse gas emissions, The Business Roundtable finds that the accord, known as the Kyoto Protocol, contains major gaps that must be filled before its impact on the world's environment and economy can be evaluated. The Business Roundtable recognizes that the Protocol is only a first step toward a comprehensive agreement to reduce emissions, but urges the Clinton Administration not to sign the Kyoto Protocol until these gaps have been addressed.

Background

On December 11, 1997, in Kyoto, Japan, the Parties to the United Nations Framework Convention on Climate Change reached an agreement, known as the Kyoto Protocol, that sets legally binding limits on the man-made emissions of greenhouse gases from 38 industrialized countries. Global carbon emissions would continue to increase under the agreement because it exempts Developing Countries—including China, India, Mexico, Brazil, and 130 others—from any commitments to limit their rapidly growing emissions. Continued growth in energy demand, and thus greenhouse gas emissions, by Developing Countries will more than offset the reductions made by Developed Countries. President Clinton is expected to sign the Kyoto Protocol later this year, but he does not intend to submit the agreement to the Senate for its constitutional role of advice and consent until "key" Developing Countries agree to "participate meaningfully" in the effort.

Key Issues of Concern

- **The targets and timetables would require the U.S. to make significant and immediate cuts in energy use.** The Protocol would require the U.S. to reduce emissions 7% below 1990 levels by 2008-2012, an unprecedented 41% reduction in projected emission levels. The process of Senate ratification and the subsequent lengthy domestic implementation process post-ratification would leave the U.S. very little time to make the painful choices regarding energy use that will be necessary to achieve these reductions. In addition, because the Protocol sets different targets for each industrialized country and the target is based on what is now an eight-year-old baseline, the U.S. in effect will shoulder a disproportionate level of reduction and may be placed at a competitive disadvantage.

- **Unless the Developing Countries also commit to emission reductions, the Protocol is incomplete and will not work.** The Byrd-Hagel Resolution, unanimously adopted by the U.S. Senate in July 1997, states that the U.S. should not be a signatory to any protocol unless it mandates "new specific scheduled commitments to limit or reduce greenhouse gas emissions for the Developing Country Parties within the same compliance period." Many Developing Countries are rapidly growing their economies and will become the largest emitters of greenhouse gases in the next 15-20 years. *Greenhouse gases know no boundaries, and stabilization of greenhouse gas concentrations cannot be achieved without global participation in a limitation-reduction effort.* Moreover, regulating the emissions of only a handful of countries could lead to the migration of energy-intensive production—such as the chemicals, steel, petroleum refining, aluminum and mining industries—from the industrialized countries to the growing Developing Countries.
- **Certain carbon "sinks" may be used to offset emission reductions, but the Protocol does not establish how sinks will be calculated.** Carbon sinks, a natural system that absorbs carbon dioxide, have tremendous potential as a means of reducing emissions, but too much is currently unknown to make a fair determination. *It is unclear how sinks might help the U.S. reach its emission-reduction commitment.* It is understood that the rules for sinks will be addressed at the Fourth Conference of the Parties (COP4) in Buenos Aires, but until they are fully fleshed out their potential impact cannot be evaluated.
- **The Protocol contains no mechanisms for compliance and enforcement.** Simply put, it would be inappropriate for any country to ratify a legally binding international agreement that lacks compliance guidelines and enforcement mechanisms. The Protocol outlines a system of domestic monitoring with oversight by international review teams, but what constitutes compliance and who judges it will not be determined until after the

Protocol enters into force. *The means of enforcement—also unknown—is equally critical, since a country's noncompliance could give it a competitive advantage over the U.S. and eviscerate the agreement's environmental goals.*

- **The Protocol includes flexible, market-based mechanisms to achieve emission reductions, but it does not establish how these mechanisms would work and to what extent they could be used.** The U.S. intends to rely heavily on market-based mechanisms to find the most efficient and cost-effective ways to reduce emissions. But until the rules and regulations are established it is uncertain how effective these mechanisms will be and to what extent they can be used by companies. Many countries are resisting these market-based mechanisms and their reluctance may hinder the development of adequate free-market guidelines. *The absence of many countries from the marketplace, and the possible limitations and restrictions on the marketplace, could render these mechanisms useless or of little value.*
- **The Protocol leaves the door open for the imposition of mandatory policies and measures to meet commitments.** Just as the U.S. favors flexible market mechanisms, the European Union and many Developing Countries favor harmonized, mandatory "command-and-control" policies and measures—such as carbon taxes and CAFÉ standards—to meet commitments, and they will have numerous opportunities to seek adoption of these policies.
- **Finally, the procedures for ratification of, and amendment to, the Kyoto Protocol make it difficult to remedy before it enters into force.** The Protocol may not be amended, nor can rules and guidelines be adopted, until after the Protocol enters into force. The Clinton Administration is now considering the negotiation of a separate or supplemental protocol to attain necessary additional commitments, but this approach would open all issues to further negotiation.

The Business Roundtable believes that the Congress and the American people cannot evaluate the Kyoto Protocol until the Administration sets out a plan as to how it intends to meet the targets of the Protocol. To place the magnitude of the U.S. reduction commitments in perspective, it is the equivalent of having to eliminate all current emissions from either the U.S. transportation sector, or the utilities sector (residential and commercial sources), or industry. The Administration needs to detail how targets in the Protocol will be met, and how the burden will be distributed among the various sectors of the economy.

The Business Roundtable feels it is imperative that a public dialogue take place on the major issues highlighted in our Gap Analysis before the Protocol becomes the law of the land and government agencies begin to write regulations.

I. INTRODUCTION

On December 11, 1997, in Kyoto, Japan, the Parties to the United Nations Framework Convention on Climate Change (the "Framework Convention" or "FCCC") reached an historic and unprecedented agreement to impose legally binding limitations on man-made greenhouse gas emissions of industrialized countries listed in Annex I to the Framework Convention (the "Developed Countries").[1] The "Kyoto Protocol" sets differentiated targets for Developed Countries to reduce or limit their emissions; the United States must reduce its emissions 7% below 1990 levels by the years 2008-2012.[2] The Protocol does not mandate specific policies or measures to achieve these reductions, and establishes, in concept, market mechanisms which may help Parties find more efficient ways to reduce emissions.

The Kyoto Protocol builds on commitments made by one hundred and sixty-seven countries under the Framework Convention in 1992 for Developed Countries to voluntarily return their greenhouse gas emissions to 1990 levels by the year 2000. In 1995, the Parties determined that voluntary aims would be insufficient and that post-2000 objectives needed to be established by the Parties. Through the "Berlin Mandate," the Parties committed to negotiate a new agreement that would include legally binding emission reduction measures for Developed Countries. The Berlin Mandate specifically excluded the Developing Countries—including China, India, Brazil, Mexico and one hundred and thirty other nations—from any new obligations to curb their emissions.

The Kyoto Protocol is open for signature at the United Nations headquarters in New York until March 15, 1999. Thereafter, Parties to the Framework Convention can still join the Protocol by accession.[3] The Protocol will enter into force on the ninetieth day after: (a) not less than fifty-five Parties have joined the Protocol; and (b) a sufficient number of Developed Countries have joined the Protocol to account for at least 55% of all carbon dioxide (CO_2) emissions by Annex I Parties in 1990.[4] The Clinton Administration has announced that the President will sign the Protocol within the one-year period at the "time that makes the most sense in terms of the overall diplomatic situation," but that he will not submit the agreement to the United

PAPER NO. 1: CANADA
(on behalf of Australia, Iceland, Japan, New Zealand, Norway,
Russian Federation, Ukraine and the United States of America)

NON-PAPER ON PRINCIPLES, MODALITIES, RULES AND GUIDELINES FOR AN INTERNATIONAL EMISSIONS TRADING REGIME

(In particular for verification, reporting and accountability)

1. PURPOSE

1. This paper sets out the preliminary views of Australia, Canada, Iceland, Japan, New Zealand, Norway, Russian Federation, Ukraine and the United States of America on the principles, modalities, rules and guidelines which provide the framework for international emissions trading. It is intended to facilitate on-going discussion on the development of an open international emissions trading system. Participation in the international trading system would be entirely voluntary.

2. The focus of the paper is on key technical design features which are necessary to provide for an effective and efficient trading system. The key objectives of the design features are to keep the system as simple and transparent as possible and minimise the transaction costs of trading while at the same time remaining consistent with the Protocol's environmental objective of achieving at least a 5% overall reduction below 1990 levels of greenhouse gas emissions by 2008-2012 for Annex B Parties.

3. A summary of the international emissions trading system proposed in this paper is contained in Appendix A.

2. INTRODUCTION

4. In December 1997, the Kyoto Protocol established emission targets for Annex B Parties. International trading is established in Article 17 of the Protocol[1]. The Conference of the Parties is authorised to decide on principles, rules, modalities and guidelines, in particular for verification, reporting and accountability.

5. Domestic measures associated with international emissions trading are for individual Parties to determine and, as such, are not addressed in this paper (beyond the need for national recording systems). However, an important consideration in designing an international emissions trading system is not to restrict the right of each Party to put in place the domestic measures it chooses. Issues such as whether and how trading is devolved to legal entities and how revenue from trading might be treated have not been addressed as these are matters for individual Parties to decide.

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[1] Any reference to an 'Article' or 'Articles' in this paper refers to Articles of the Kyoto Protocol. Similarly, any reference to a 'Party' or 'Parties' refers to Parties of the Protocol.

3. WHAT IS EMISSIONS TRADING?

6. Emissions trading is a market based approach which enables participants to cooperatively minimise the costs of achieving an environmental objective. In the case of the Kyoto Protocol, an environmental objective has been established as the aggregate total of all individual quantified emission limitation and reduction commitments, as set out in Annex B of the Protocol for the first commitment period (2008-2012).

7. Through emissions trading, a market price for emissions abatement will emerge which reflects the marginal cost of emissions abatement[2] across all market participants. When participants have exhausted the opportunities available for domestic emission reductions, or sink enhancement as per Article 3(3), at a cost below the international market price, they can elect to purchase the requisite 'assigned amounts' from other Parties (or entities). In this way, the environmental benefits are achieved, irrespective of where the reductions take place, and at a lower cost than if trading was not available.

8. Since emissions trading is entirely voluntary, each trade will be to the mutual benefit of both participants to the trade[3]. Cooperation between countries in this manner will lower the aggregate cost of emission abatement to below that which would be incurred by countries acting alone. Thus, the incentives provided by trading will facilitate the achievement of the Protocol's environmental objective; and at a lower cost than would be incurred without trading[4].

4. DESIGN FEATURES

9. In developing a framework for international emissions trading, several simple design features need to be considered to enhance the integrity of the trading system and increase the level of certainty under which it operates. These design features should facilitate the efficient operation of a competitive market which will enhance the achievement of the environmental objective.

10. Parties could trade directly and/or choose to devolve trading responsibility to legal entities. Devolving the ability to trade would be likely to increase the number of trades, thus enhancing competition in the market. Private sector legal entities would have direct knowledge of their abatement opportunities and costs and would likely be better placed to make decisions based on this information than would governments.

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[2] The marginal cost of emissions abatement is the cost of undertaking the next cheapest unit of emissions abatement over and above the current level of abatement.

[3] Use of the word 'trade' in this paper applies to acquisitions or transfers.

[4] Experience with emissions trading, mainly in the United States, has demonstrated it to be a cost-effective tool for addressing air pollution problems. For example, in the sulphur dioxide (SO_2) trading regime, firms are reducing emissions in excess of requirements in Phase I of the programme and accumulating a large bank of allowances for use in Phase II that begins in January 2000. Additionally, the price of allowances is much lower than anticipated and the cost to industry of emission reductions has been dramatically less than projections by both industry and regulators anticipated before the adoption of the programme.

11. To enhance the efficiency of the market, the unit of trade should be clearly denominated and freely transferable amongst trading participants. Rules which encourage transparency and information disclosure and provide appropriate incentives for compliance can also aid the efficient operation of the market[5]. Comprehensively specified and certain rules assist in minimising the transaction, administration and compliance costs of trading. In order to be accountable and certain, the rules (including monitoring and enforcement mechanisms) would apply to all participating Parties. Rules should maintain enough flexibility to accommodate changes to the system in the future (e.g. new entrants).

5. WHAT IS THE TRADABLE UNIT?

12. Assigned amount units (AAUs) would be the standardised unit of trade. AAUs would represent a tradable form of an Annex B Party's 'assigned amount'. Parties who wished to trade would issue tradable AAUs from its 'assigned amount'. Parties would be required to identify the AAUs that they issued with a unique serial number which identified the country of origin and the relevant commitment period[6]. This would ensure that each AAU is unique internationally.

13. 'Assigned amounts' can be traded, whether they derive from, for example, Articles 3(7), 3(3), 6 and/or 12. There would be no differentiation of AAUs on the basis of data certainty for gases or sources.

5.1 Specification of AAUs

14. Consistent with Article 3(1), AAUs would be denominated in 'CO_2 equivalent'. Consistent with Article 5(3), Global Warming Potentials (GWPs) would be used as the appropriate conversion factors to convert non-CO_2 gases into CO_2 equivalent terms and would be fixed for a commitment period. For the first commitment period, Parties should use the revised 1996 Guidelines for National Greenhouse Gas Inventories of the IPCC. GWPs used by Parties should be those provided by the IPCC in its Second Assessment Report based on the effects of the greenhouse gases over a 100 year time horizon, taking into account the inherent and complicated uncertainties involved in global warming potential estimates.

15. An AAU would express one metric tonne of CO_2 equivalent emissions. All AAUs would be valid for the commitment period in which they are issued and indefinitely thereafter until used. An AAU could only be used once to offset emissions equal to the CO_2 equivalent value (i.e. AAUs are a consumable commodity)[7].

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[5] Transparency of the regime refers to public disclosure of information, more specifically, disclosure of emission levels, assigned amounts and transfers between trading participants. Disclosure of this information would be based on the public reporting of these data by Parties and reports by the FCCC Secretariat.

[6] It may be useful if a standardised format was used for serialisation. It would also simplify and enhance the 'book keeping' process for Parties when recording acquisitions and transfers of AAUs.

[7] A Party could request that any AAUs not used within a current commitment period be banked forward into a subsequent period, consistent with Article 3(13). This procedure could become automatic at the end of each commitment period if requested by that Party.

6. WHO CAN PARTICIPATE IN THE TRADING REGIME?

16. The participants in the international trading regime could be Parties (i.e. governments) and/or legal entities authorised by that Party to trade. Legal entities could include private individuals, companies, societies (which could include environmental and other non-governmental organisations), industry groups and brokers.

17. Devolution of the right to trade to legal entities would be at the discretion of each participating Party. However, responsibility for the Kyoto Protocol commitments would always remain with the Government as Party to the Protocol.

7. CONDITIONS TO TRADE 'ASSIGNED AMOUNTS' INTERNATIONALLY

18. Each Annex B Party will need to meet conditions to ensure the integrity of the system. These conditions are:

(a) Parties must comply with Articles 5 & 7 of the Kyoto Protocol.

(b) Parties must establish and maintain a national system for recording their 'assigned amount' and accounting and tracking AAUs held or traded by the Party and/or its legal entities.

19. Compliance with the conditions would be assumed to continue unless a breach of the conditions was established under the Protocol. Failure to maintain compliance with the conditions could result in suspension of the right for the Party and its legal entities to transfer AAUs internationally. However, the Party or its legal entities would not be precluded from acquiring AAUs.

8. HOW MUCH CAN BE TRADED?

20. Article 17 provides that trading is to be supplemental to domestic actions but does not quantify that term or authorise the Conference of the Parties to quantify it.

21. International emissions trading will be more effective in achieving emissions reduction at lowest cost if there are no restrictions on the quantity of AAUs able to be transferred or acquired to contribute to compliance with a Party's 'assigned amount'. The ability to trade without quantitative restriction would encourage ratification of the Protocol; encourage earlier emission reductions and minimise the overall cost of achieving the collective Annex B environmental objective.

22. Internationally mandated limits on the quantity available to be traded, by substantially reducing the benefits available from trading, would increase the cost of emission reductions; discourage ratification of the Protocol; and ultimately, in the long term, reduce the quantity of reductions that can be achieved, thus delivering less environmental benefit.

9. INSTITUTIONAL REQUIREMENTS

23. Markets play a central role in the efficient exchange of "goods" such as commodities, shares, bonds and financial instruments. Existing international markets have a number of well-established practices for contracting, delivery and settlement. An issue for international emissions trading is whether it is necessary to establish a new official institution to facilitate trades. Given the large number of existing commercial market institutions that handle international transactions (both financial and commodity), there seems no benefit in establishing a new international forum/institution to cater for trades of AAUs[8]. The only additional function, over and above those required in the absence of trading, is a system to record ownership and transfers of AAUs at the national level. This system is discussed below.

9.1 National Recording System

24. The national recording system of a Party would record AAUs issued by the Party and transfers and acquisitions of AAUs by the Party, including those AAUs devolved to legal entities, and subsequent transactions by those entities. The national recording system would also be required to provide verification of ownership of AAUs. A Party could choose to maintain a list of all legal entities it authorises to trade.

25. By recording every change of legal ownership, the national recording system would protect against the possibility of counterfeit AAUs being generated and questions regarding legal ownership of legitimate AAUs[9].

26. Each Party would be required to report annually on trading activity to a designated authority approved by the FCCC COP[10]. This report would identify the aggregate quantity of international trades and any changes to the Party's 'assigned amount' pursuant to Articles 3(3), 3(10), 3(11) and 3(12). This would enable the designated authority to produce a synthesis report of each Party's 'assigned amount', including AAU holdings by each Party and transfers to, and acquisitions from, other Parties.

27. The synthesis report would confirm, at an aggregate level, that correct double-entry book keeping between Parties had occurred. In the event of discrepancies in the reports submitted by Parties, the designated authority would request that those Parties investigate and correct such discrepancies.

28. Two or more Parties could voluntarily consolidate their national recording systems

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[8] For example, in the USEPA sulphur dioxide (SO_2) market, no forum or institution was established to facilitate the exchange of SO_2 allowances. Instead, several brokerages have emerged to facilitate private transactions.

[9] "Contract trades" for transferring or acquiring AAUs at a specified time in the future would not need to be recorded until the actual trade occurred and the AAUs were officially transferred to the new owner (i.e. the legal ownership changed).

[10] Reporting annual trading activity would complement annual emission inventories prepared by Parties under Article 7. Information from a Party's national recording system could be made publicly accessible more frequently.

into one system, provided that each individual Party's account was reflected. This might simplify tracking of AAU transfers and preparation of synthesis reports as well as reduce the possibility of discrepancies between Parties' reports on trading activity.

9.2 Tracking AAU holdings

29. One way to track AAU trades by the Party and its legal entities would be for the national recording system to operate an account for the Party and accounts for all legal entities authorised to trade.

30. All trades of AAUs would result in a debit and credit to the relevant accounts (i.e. a simple double-entry accounting system). For international trades, the 'seller' would request that its national recording system remove the AAUs in question from its account and authorise the national recording system of the 'buyer' to credit the buyer's account with those AAUs. For domestic trades (i.e. those that did not cross national borders) only the national recording system in that country would need to be involved.

31. National recording systems would only be required to track the account from which AAUs are to be transferred from (or to) and the quantity of AAUs to be transferred (including the serial numbers for the purpose of verifying ownership). Contractual information beyond the number of AAUs transferred between participants would not have to be divulged. Participants could choose not to divulge price details of individual trades to protect commercially sensitive information. Average current prices would be revealed through market mechanisms such as exchanges and brokers.

10. VERIFICATION AND ACCOUNTABILITY

32. The trading rules should provide appropriate compliance and enforcement mechanisms relevant to the trading system. Other compliance issues could be addressed under Article 18.

33. One enforcement mechanism under the trading rules could be to deny (or restrict) the right of a Party (and its legal entities) to transfer AAUs if they are found to be in breach of the trading rules and/or are no longer in compliance with the conditions for issuing AAUs (e.g. in breach of conditions to trade AAUs internationally).

10.1 Establishing Compliance

34. Each Party will be assessed for compliance at the end of the commitment period. For a Party to be found in compliance with Article 3, its emissions must be no more than its 'assigned amount'.

35. At the end of the commitment period and following finalisation of emission inventories, each Party would be required to submit a report to the designated authority[11]. This report would include emissions for the commitment period and aggregate information on the number of acquisitions and transfers of AAUs and any changes to a Party's 'assigned amount' pursuant to Articles 3(3), 3(10), 3(11) and 3(12) (i.e. a compilation of annual emission inventories and information on trading activity). Based on this information, the Party could ascertain whether it had exceeded its 'assigned amount'.

36. The report would also indicate the serial numbers of AAUs used by the Party for the purposes of contributing to compliance. AAUs used by the Party to contribute to compliance would no longer be valid and would be required to be removed from the Party's national recording system (i.e. AAUs are a consumable commodity). At a Party's request, any AAUs not used to offset emissions or the remaining portion of its 'assigned amount' would be banked forward into the next commitment period pursuant to Article 3(13).

37. A Party that had exceeded its 'assigned amount' would be able to come into compliance during a short grace period (e.g. three months). To meet the shortfall, a Party could either purchase AAUs within the grace period and/or utilise other options to meet the shortfall. After the completion of the grace period, Parties would re-submit a (modified) report. Parties who were non-complying could face non-compliance consequences developed under Article 18.

11. FURTHER WORK

38. Some rules or a process to deal with instances of anti-competitive behaviour may be necessary. Issues regarding allocation of risk need to be further explored.

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[11] The submission of final reports would depend on the speed in which national inventories could be prepared by each Party. It would be in the interest of an efficient process in this regard that Article 5.1 of the Protocol, pertaining to national inventories, addressed this issue and required inventories to be submitted within a relatively short timeframe.

APPENDIX A - SUMMARY OF THE TRADING SYSTEM

1. International trading is established in Article 17 of the Kyoto Protocol.
2. Parties could elect to participate in the trading system.
3. The tradable unit would be Assigned amount units (AAUs) i.e. AAUs are the tradable form of 'assigned amounts'.
4. AAUs would be denominated in CO_2 equivalent. The unit of trade would be one metric tonne. GWPs used to calculate CO_2 equivalence would be fixed for a commitment period.
5. Each Annex B Party could issue serialised AAUs from its 'assigned amount'.
6. Each AAU would have a unique serial number which identified the country of origin and the commitment period in which the AAUs were issued.
7. AAUs would be valid until used to offset emissions for the purposes of contributing to compliance (i.e. once used to offset emissions, AAUs would be removed from the trading system).
8. AAUs acquired by a Party with an 'assigned amount' would be added to the Party's 'assigned amount'. Similarly, AAUs transferred by a Party would be subtracted from its 'assigned amount'.
9. 'Assigned amounts' can be traded, whether they derive from, for example, Articles 3(7), 3(3), 6 and/or 12.
10. Parties could authorise legal entities to acquire and/or transfer AAUs. Issues such as whether and how trading is devolved to legal entities and how revenue from trading might be treated are matters for individual Parties to decide.
11. Governments, as Parties to the Kyoto Protocol, would remain responsible for compliance with their 'assigned amount'.
12. Each Annex B Party who wanted to trade its AAUs internationally (and/or allow their legal entities to do so) will need to meet the following conditions:
    (a) Parties must comply with Articles 5 & 7 of the Kyoto Protocol.
    (b) Parties must establish and maintain a national system for recording their 'assigned amount' and accounting and tracking AAUs held, transferred or acquired by a Party and/or its legal entities.
13. The national recording system of a Party would be required to:
    (a) record AAUs issued by the Party;
    (b) record transfers and acquisitions of AAUs by the Party (including those AAUs transferred by the Party to legal entities, and subsequent transactions by those entities);
    (c) provide verification that a legal entity transferring AAUs was the registered owner of the AAUs in question; and
    (d) retire AAUs used to offset emissions.
14. Each Party would be required to report annually on trading activity to an authority designated by the COP identifying the quantity of international trades and any changes to its 'assigned amount' pursuant to Articles 3(3), 3(10), 3(11) and/or 3(12).
15. Each Party will be assessed for compliance at the end of the commitment period. For

a Party to be found in compliance with Article 3, its emissions must be no more than its 'assigned amount'. To assess compliance at the end of the commitment period (and following finalisation of emission inventories), each Party would be required to submit a report to the designated authority on emissions for the period and aggregate information on the number of acquisitions and transfers of AAUs and any changes to a Party's 'assigned amount' pursuant to Articles 3(3), 3(10), 3(11) and 3(12) (i.e. a compilation of annual emission inventories and information on trading activity).

16. Parties would inform the designated authority which AAUs (identified by serial number) were used to offset emissions. Such AAUs would no longer be valid for use in a subsequent commitment period.

17. A Party that had exceeded its 'assigned amount' would be able to come into compliance during a short grace period (e.g 3 months). To meet the shortfall, the Party could either acquire AAUs within the grace period and/or utilise other options to meet the shortfall.

18. After the completion of the grace period, Parties would re-submit a modified report. Parties who were non-complying could face non-compliance consequences developed under Article 18.

19. Any AAUs not used to offset emissions or remaining portions of a Party's 'assigned amount' not used could be banked forward into the following commitment period at the request of a Party (including on behalf of legal entities).

PAPER NO.1: INDONESIA
(on behalf of the Group of 77 and China)

POSITION PAPER OF THE GROUP OF 77 & CHINA ON THE MECHANISM OF THE KYOTO PROTOCOL FOR THE SECOND MEETING OF THE CONTACT GROUP ON MECHANISM

The Group of 77 & China recalls the principles of the United Nations Framework Convention on Climate Change, and affirms that any international mechanism being introduced through the Convention or the Kyoto Protocol to the Convention should be in conformity with the principles of the Convention. The rules governing the mechanisms, namely, activities implemented jointly, joint implementation, clean development mechanism and emission trading should be determined on the basis of equity, sustainable development and the other principles of the Convention. The mechanisms are off-shore measures. It has to be ensured that their design does not in any way compromise the modification of longer-term trends in anthropogenic emissions, consistent with the objective of the Convention. The mechanisms should be supplemental to domestic action. The greenhouse gas reductions achieved should be real and verifiable.

2. The new mechanisms indicated in the Kyoto Protocol are yet to be defined in terms of principles and modalities, rules and guidelines. Presently, these mechanisms are immersed in uncertainty. An important reason why this is so is because preparatory work was lacking on these mechanisms during the negotiations related to the Kyoto Protocol. With respect to the clean development mechanism and emission trading, there was no preparatory work. In any case, there are very complex and intricate methodological, technical, legal and institutional questions requiring addressal.

3. It was in this background that the Group of 77 & China had taken the position during the Kyoto negotiations that until these questions were resolved, joint implementation and emission trading should not be introduced. In respect of emission trading, the Group of 77 & China had stated that until the question of emission rights and entitlements is addressed equitably, it would not be possible to have emission trading. The question of the legal and equitable basis of entitlements continues to occupy a central position. In view of the highly complicated nature of the issues confronting the parties, the course of action should be to make due endeavour to identify the questions for the purpose of discussion and resolution. For this, preparatory work is needed.

4. The Convention secretariat can contribute to this preparatory work. It was in this light that the Chairmen of the Subsidiary Bodies were requested (Decision 1/CP.3) to give guidance to the secretariat on the preparatory work needed for consideration by the Conference of the Parties. Due thought and effort is needed to identify the issues. This cannot and should not be rushed. A significant disadvantage confronting developing countries is that they lack know-how. Discussion and debate cannot proceed if the parties lack the requisite understanding of the issues being negotiated. It is imperative that the Group of 77 & China have an understanding of the issues because the Group, which

combines the insights and perceptions of a very large body of developing economies, is, as always, keen to contribute to discussions on climate change. More preparatory work will help in this regard.

5. The preparatory work should be conducted so that the methodological questions are addressed first. The prevailing uncertainties must be removed. Without proper addressal of the methodological questions, it will not be possible to have discussions on substantive issues. The time for discussions on substantive issues will come later. The methodological questions should be addressed and responded to by the Subsidiary Body for Scientific and Technological Advice.

6. There should be no prioritisation or hierarchy assigned to the mechanisms. All the mechanisms have to be examined on the basis of the principles of equity, sustainable development, the other principles of the Convention, and in the light of the objectives of the Convention.

7. AIJ is in the pilot phase, a comprehensive review of which should take place in accordance with COP decisions, with further course of action to be decided subsequent to review by the COP.

8. The conception and design of the mechanisms should rest with the Conference of the Parties to the Convention, assisted by the SBSTA and the SBI in accordance with their division of labour in the Convention. The COP is the highest decision making body of the Convention. The COP also has valuable experience in respect of the implementation of the Convention and its requirements. Very importantly, the COP has the fuller-term insights of the parties to the Convention. The merging trend, wherein other international multilateral agencies, are also getting involved in the conduct of workshops, etc. on the mechanisms is viewed with concern by the Group of 77 & China. This trend is pre-judging the outcome of the Convention process.

PAPER NO.2: UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND (on behalf of the European Community and its member States and Czech Republic, Slovakia, Croatia, Latvia, Switzerland, Slovenia, Poland and Bulgaria)

NON-PAPER ON PRINCIPLES; MODALITIES; RULES AND GUIDELINES FOR AN INTERNATIONAL EMISSIONS TRADING REGIME

(as part of detailed comments on the mechanisms)

Purpose

1. This paper sets out the preliminary views of the European Community, Austria, Germany, Finland, Portugal, France, Sweden, Belgium, Spain, Denmark, Greece, Italy, Ireland, The Netherlands, Luxembourg, United Kingdom, Czech Republic, Slovakia, Croatia, Latvia, Switzerland, Slovenia, Poland and Bulgaria on the principles, modalities, rules and guidelines which should provide the framework for international emissions trading. The above Parties believe that trading, CDM and JI should be developed in parallel and the frameworks for them should be consistent with each other. However, this paper refers to international emissions trading. It is intended as a basis for the on-going discussion on the development of an open international emissions trading system.

2. This paper includes some key technical elements that can be already presented as potential rules, modalities and guidelines and others which are also necessary to provide for an effective and efficient trading system but have to be further developed.

Summary of the draft international emissions trading system

Principles

3. Recalling the principles and objectives of the United Nations Framework Convention on Climate Change, and the Kyoto Protocol, the international emissions trading system shall be designed to contribute to the achievement of real, cost-effective and verifiable environmental benefits whilst ensuring that:

(i) trading of "hot air" should not lead to overall reductions being lower than would otherwise be the case;

(ii) trading is supplemental to domestic action for the purposes of meeting commitments under Article 3* (in accordance with Article 17); and

(iii) the emissions trading system is transparent, accessible and verifiable, functions in a non-discriminatory manner, and does not lead to distortions of competition.

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* Any reference to an 'Article' or 'Articles' in this paper refers to Articles of the Kyoto Protocol unless otherwise stated.

4. The above Parties believe that the rules, modalities and guidelines need to be defined before international emissions trading can begin.

Implementation of Principles governing the international trading system

Supplementarity:

5. We believe that domestic actions should provide the main means of meeting commitments under Article 3. This is consistent with the ultimate objective of the Convention. In this context a "concrete ceiling" on the use of all the flexible mechanisms has to be defined. In addition, Article 17 states that international emissions trading "....shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments....". The rules governing the international emissions trading system should reflect this principle.

6. We have not yet come to a firm view on as to how the ceiling should be defined and welcomes discussion with other delegations. The ceiling could be defined in relation to a number of variables, including: the assigned amount, 1990 emission levels, or required efforts by a Party.

Environmental effectiveness:

7. The above Parties believe that international emissions trading should ensure that real emissions reductions are delivered at lower cost, and that the trading of 'hot air' should not lead to overall reductions being lower than would otherwise be the case.

This could require that:

Net transfers by a Party shall not be greater than the amount of emissions reduced by that Party as a result of domestic action.

A Party's compliance with this rule shall be the subject of expert review under Article 8.

Emissions trading market

8. We believe that there should be an open and transparent emissions trading market subject to the modalities, rules and guidelines as set out below.

Modalities, Rules and Guidelines

Eligibility

9. Parties with commitments listed in Annex B of the Kyoto Protocol shall be eligible to transfer or acquire parts of assigned amounts if they:

(a) are in compliance with Articles 5 and 7**;

(b) have adopted and ratified a compliance regime under Article 18;

(c) have a national system for tracking transfers and acquisitions of parts of assigned amount by the Party itself, and by any legal entities it may choose to authorise (consistent with paragraphs 10, 15 and 16 below);

(d) can demonstrate their compliance with the rules of the emissions trading system, as set out in the paragraphs below.

Parties' implementation of the requirements of this paragraph shall be the subject of expert review under Article 8.

Unit of transfer/acquisition

10. The tradeable unit would be parts of assigned amounts, (as defined under Article 3) which this paper will refer to as PAA units. Transfers and acquisitions of PAA units shall be denominated in metric tons of CO2 equivalent, calculated using the global warming potentials defined by decision 2/CP.3 or as subsequently revised in accordance with Article 5.3. One PAA unit would be equal to one metric tonne of CO2 equivalent emissions.

11. All PAA units shall have a unique serial number that reflects the country of origin and the commitment period for which the assigned amount was first established. PAA units would be valid until used to offset emissions for the purposes of contributing to compliance (i.e. once used to offset emissions, PAA units would be retired from the trading system). PAA units acquired by a Party would be added to the Party's assigned amount unless the PAA units are subsequently invalidated as set out in paragraph 22 below. Similarly, PAA units transferred by a Party would be subtracted from its assigned amount.

12. A Party whose emissions are in excess of its assigned amount in any commitment period may acquire, but may not transfer, PAAs.

Entitlement to trade

13. All eligible Parties can trade.

14. The Protocol is silent on the subject of whether legal entities can participate in the international trading system under Article 17. However, the participation of legal entities has several economic advantages. If authorised legal entities are permitted to participate in international emissions trading, the Party, and not its authorised legal entities, will remain responsible for compliance with its commitments under the Protocol.

** The EU assumes that the existing accounting and reporting requirements are enhanced appropriately and that only Parties which fulfil such requirements are eligible to trade.

15. If legal entities were permitted to trade internationally, it would be essential to govern the monitoring, verification, accountability and compliance of sub-national legal entities. In addition, the manner in which Parties allocate PAA units to their legal entities should not contravene Article 3.5 of the Convention and, therefore, should avoid arbitrary or unjustifiable discrimination or a disguised restriction on international trade.

Recording and Reporting of Trades

16. The UNFCCC Secretariat shall make information on the Parties that are eligible to participate in international trade publicly available. Each Party shall maintain a record of names and contact details of authorised legal entities within its jurisdiction that it authorises to trade, and such information shall be made available both to the UNFCCC Secretariat and to the public.

17. Parties shall track and record information on all transfers of PAA units by authorised legal entities within their jurisdiction. This information should include the amount and serial numbers of the PAA units transferred, and identify the entities and their authorising Parties between which the transaction has taken place.

18. Parties shall report, at least annually, to the UNFCCC secretariat (or an authority designated by the COP) the amount and serial numbers of the PAA units and the counterparts of all transfers and acquisitions that result in changes to their assigned amounts, including those involving legal entities. Parties shall verify to the UNFCCC Secretariat (or an authority designated by the COP) that a legal entity transferring PAA units was the registered owner of the PAA units in question.

19. The UNFCCC secretariat (or an authority designated by the COP) shall produce, on an annual basis, a tabulation of the adjustments to assigned amounts required under Articles 3.10 and 3.11 for each Party that has carried out transfers or acquisitions of PAA units.

Market mechanisms and information:

20. There are a number of ways in which the emissions trading market could be organised. The following sets out the main options (these provisions could also apply to legal entities):

(a) **Auction**. Any transfers or acquisitions by a Party shall be carried out through open, competitive bidding accessible to all Parties.

(b) **Prior notification**. Parties shall notify the UNFCCC of their intention to transfer or acquire PAA units prior to any transfer/acquisition, and the UNFCCC Secretariat shall make such information available to all other eligible Parties. This could be limited to transfers/acquisitions above a specified amount.

(c) Use of available market mechanisms. Transfers and acquisitions by Parties may be carried out directly or through any mechanisms to facilitate transfers such as brokers, exchanges, or auctions.

Sharing of risks of non-compliance under the international emissions trading system:

21. Rules about risk-sharing and legal liability will need to be elaborated, in order, inter alia, to provide compliance incentives and to improve the quality of Parties' monitoring systems. This section sets out the main parameters.

22. Party which is found to be in non-compliance with its obligations under Article 3 will face compliance procedures under Article 18. If such a Party has transferred PAA units to any other Party, the units transferred should be invalidated in part, or in full, for the purposes of meeting the commitments of the acquiring Parties under the Protocol. Otherwise, Parties could have no incentive not to buy PAA units from Parties they expected to be in eventual non-compliance. Modalities for invalidation of PAA units transferred under these circumstances will need to be further explored. However, if a Party finds itself in non-compliance due to the full or partial invalidation of acquired PAA units, it may be appropriate for that Party to face less stringent penalties than the seller Party.

Compliance with trading rules

23. If a question of compliance by a Party included in Annex B of the rules of the trading system as set out in the paragraphs above is identified, transfers and acquisitions of assigned emission units may continue to be made after the question has been identified, provided that any such units may not be used by a Party to meet its commitments under Article 3 until any issue of compliance is resolved.

Changes (i.e. participants, trading rules etc.):

24. Any rules, modalities and guidelines for emissions trading shall be open to review by the Parties and may be modified as appropriate by a COP.

25. Changes in trading principles, modalities, rules, and guidelines shall only take effect in commitment periods subsequent to that of their adoption. Changes in Parties' eligibility to trade or changes pertaining to new entrants that meet the eligibility criteria may occur during the current commitment period.

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